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Vol. VI. NEW YORK, SEPT. 26, 1885. No. 13.

SHOULD the Egyptian government insist, as it intimated at the Berlin Conference, on better terms for cabling, the Eastern Telegraph Company stands to lose, on the confession of its own representative, not less than $350,000 a year. There have been some rich pickings in past years out of poor Egypt.

THE Western Union Telegraph Company in Philadelphia has rented a church for its new main office. The building in question is at the southeast corner of Broad and Merrick streets, and was known as the "Tabernacle Presbyterian Church." It is feared that while the recollections clustered around the old structure will be very edifying, the atmosphere may not agree with some of the old-timers.

THE aggregate capital of the twenty-six companies owning the submarine cables of the world is over $150,000,000, and it has been proposed by Sir James Anderson that an international government syndicate should be formed to buy up these cables, and work them at a tariff common to all nations. The scheme is grandiose, but seems to us to lack many elements of practicability or desirability. In its present shape it involves the working of the cables by the companies through managing boards under the international supervision. No doubt the companies would be very glad to sell their cables for a good round sum, and then have their directors salaried for life to keep them in repair.

THE advanced position which this country occupies in the field of what is termed "special" machinery is again exemplified in the recent announcement made by an English telephone manufacturing company. The latter have ordered a set of machinery from this country for turning out their apparatus, and they will be able, it is admitted, to increase their output largely thereby. Considering that America is the home of the telephone, it is not surprising that it should be the most advanced in the machinery for its manufacture.

THE sensible course adopted by the operators in declining to work "extra" without extra pay seems to be proving eminently successful. A strike would have been disastrous, but an absolute refusal to work extra for nothing throws the burden of discharging them on the company, and thus paves the way for a suit at law for damages. This conservative method has already been successful in bringing about an amelioration of the hardship in the West, and it should be persevered in, firmly but respectfully.

THE Bell-Reis telephone controversy, which has lately been stirred up again in the courts, moves Prof. Sylvanus P. Thompson to relieve his mind once more upon this favorite subject of his. In a letter to the London *Electrical Review*, he enters into the question anew in a very brisk manner, but brings to light nothing which he has not mentioned before. Our readers will remember the interesting controversy between Prof. Thompson, on the side of Reis, and Mr. Berliner, on that of Bell, which was waged in our columns some time ago.

Now that the British standard wire gauge has been adopted by one electrical association, the general inquiry naturally turns to the table of sizes, and the difference between the new and the old. We have therefore given in another column a comparative table showing the difference between the new standard, the Brown & Sharpe and Birmingham wire gauges. It will be noticed that the difference between the standard and Birmingham wire gauge is comparatively small, but the disparity is quite appreciable in the case of the Brown & Sharpe gauge.

WE give in this issue further particulars about the course of the telephone fight in Indiana, where suit was brought to compel the Cumberland Company to give service to business firms at the ridiculously low rate of $36 per year, instead of at the reasonable rate asked of $60 per year. The company has our hearty sympathies in its fight for life. It can but ask such rates in view of the royalty it has to pay, and if a patentee may not ask for the royalty that he thinks he ought to have under the covenant he makes with the United States, then the patent laws should be changed.

THE heretofore universally prevalent idea that a voltaic cell required a *liquid* electrolyte seems to be open to doubt in the light of some recent experiments. We note in English papers the investigations of Mr. Shelford Bidwell, who has been able to obtain an appreciable current from a battery having a *solid* electrolyte. Further study in this interesting field may lead to results whose importance it would be difficult to foretell. The inherent qualities of such cells would, however, seem to bar their use for practical purposes, as the electromotive force is very low and the internal resistance high.

IN the light of the difficulty experienced with underground wires, recently complained of by the President of the Western Union Company before the New York Underground Wire Commission, it is refreshing to read that the new subterranean telegraph lines connecting Paris and Marseilles have been completed. These cities are, we believe, some 400 miles apart, and yet there appear to have been no insurmountable difficulties encountered; in fact, it was merely a repetition of what had been done before. Judging from the experiences related by Dr. Green, the Western Union offers a good example of how not to do it, or else prefers quick working on its wires.

IT is now evident that the British Admiralty is fully cognizant of the value of the electric light on board vessels in the Royal Navy, and the number of orders given to electrical firms of late is unprecedented. Our own naval authorities have been rather slow in installing the electric light on war vessels, but we believe that the time is not far distant when it will be considered as necessary a part of their equipment as the engines or guns. Not only will electricity be applied to lighting, but it will be the power employed in handling the guns, for which purpose it is eminently adapted. There are, besides, numerous other offices which it will be made to perform, and for which it will undoubtedly be called upon in the near future.

FOR some time past we have received numerous communications from correspondents inquiring as to the existence of a telephone relay. Interest in this matter is quite natural, as a telephonic relay or repeater would at once appear to solve the problem of long-distance telephony. Many minds have no doubt been, and are still, at work upon the problem, but they seem to have kept a discreet silence. The first patent, we believe, which has been granted in this country on such a device has recently been issued, and last week we gave a full description of it. The method employed is an ingenious one, and we await with interest the results of experiments with the apparatus. If it should prove successful, we may look forward to a large amount of telephonic communication between our large cities, and this will prove an additional source of income to the telephone exchanges.

THE electric light, as used for advertising purposes, is in a bad way in England. It was noted by us last week that a London theatre had several men perambulating the streets with balloons, within which were placed electric lamps which were flashed at intervals. One of the men was arrested recently and fined on the complaint of the police, who declared that the devices frightened passing horses. The defense claimed that the object in sending out the men was not merely for the purpose of advertising, but also for affording an additional illumination for the streets, which were poorly lighted in that part of the town. This ingenious defense was not deemed sufficient, and a nominal fine of one shilling was imposed. We would suggest that advertisers in this country contemplating the use of similar methods first obtain the permission of the proper authorities, or "square" them.

OPEN-CIRCUIT batteries have so long been constructed on practically the same principle that a departure from the old method must attract attention. Heretofore sal ammoniac has been universally employed with or without dioxide of manganese as a depolarizer, but in the new cell which we describe in another column, an entirely different substance is employed. From the description it will be seen that chemicals rich in oxygen are employed which not only act as a depolarizer, but the interaction of which in contact with the zinc is said to be the seat of the electromotive force. As in most of the cells that have been in use for many years, the chemical products resulting from the electric action are not known. This is a field in which chemistry has advanced very little, but which is worthy of the most profound study. Many of the salts formed in galvanic batteries have never been analyzed. The law of their formation has itself never been enunciated, and for obvious reasons. From the limited study which has been devoted to the subject, it has been determined that the products formed in a cell vary in every conceivable manner, according to the conditions under which it is used. Every variation of current or electromotive force in a series of cells causes a change in the resulting products, and thus a single determination would have no value except as a special case. Active investigation in this direction might lead to methods of producing commercial chemicals in a more economical way than pursued at present, so that the time be stowed upon it would find ample remuneration. Though at present neglected, we have no doubt that the time will come when galvanic batteries will be the subject of special study from a new chemical point of view.

THE hue and cry which is now being raised in New England on account of the stiffening in telephone rates seems to be nearly all cry and little wool. The whole affair hinges practically on a trivial increase for residences from $30 to $36, and for business houses from $36 to $42. We gave lately the full schedule for the various towns, according with their respective populations. The telephone can now no longer be looked upon as a minor convenience. It is a necessity, and we maintain that if a subscriber has no more use for a telephone than is represented by an outlay of $42 per annum, he evidently does not need the telephone at all. It is claimed that a number of people have ordered their telephones out rather than submit to the alleged imposition, but we venture to say that no subscriber who really needs a telephone will stand upon a "raise" of $6 a year. While we would like to see telephone rates as cheap as they can be made, being ourselves subscribers, we do not think the increased charges at all excessive, especially when compared with the rates in other cities. We would draw attention, however, to the fact, which is brought out by this "war," that the increase would be borne with more patience if the telephone service were good. Here is a chance for the companies to reconcile their customers. Even with the lowest rates, poor service is dearly paid for. At the present time there is no excuse for poor telephone service, for the improved exchange apparatus now built is competent to give the best service with intelligent operators. We would suggest as a remedy that the number of operators at the central offices be increased, so that calls are more promptly answered. A trouble clerk in each exchange would also tend to improve the service to a considerable extent. We have no fear, however, that the New England troubles will be anything more than a temporary eruption, and when both sides consider the subject in its true aspect, and the proper remedies are applied, peace and contentment will once more reign. The same remarks might well apply to Indiana, save that there the matter has been complicated by irresponsible legislation.

Cipher Telegraph Codes.

The use of code systems is greatly on the increase. Some make up their own, but the majority of business men have systems specially printed for them, or make them up out of the cipher books, which are to be had of all commercial stationers.

Mr. E. Parke Coby, the Adjutant of the Veteran Corps of the Forty-seventh Regiment, when asked about cipher systems by a *Sun* reporter recently, took the questioner to the fourth story of a printing establishment, where a thin, dark little man, with intensely black eyes, was found cutting three dictionaries to pieces with a huge pair of shears. The dictionaries were in English, Spanish and German, and the little man cut long strips of words from them, which he pasted on paper, and then drew lead-pencil lines from the words to written sentences.

"He is connected with a South American steamship company, and is preparing copy for a cipher system for his line," explained the printer. "We will not print more than half a dozen of the books, but the cost will be over $200. After we strike off the required number of copies we destroy the forms, and do not even keep a sample for ourselves. You see the companies guard their secret ciphers as a man guards the apple of his eye. It would never do to let rivals or interested speculators get hold of their codes, or the company would often be forestalled in the market. We do considerable cipher work for exporters and importers, and men in the iron and foreign trades, as well as for steamship companies, but we never allow the work, when off the press, to be seen by any one except its owners. Cipher systems are coming greatly into vogue with the business men of New York. There is a great saving of expense in the use of the wires and less chance of misinterpretation and mistakes than when sending fully written dispatches. Some customers are very secretive about their systems, and others do not appear to care anything for concealment. We get up a cipher system on an interchangeable plan by which not even the printer of the book can know the meaning of the code words."

"What is the expense?"

"Cipher systems, or codes, as they are called, when they are made to order, cost from $50 up. Some run as high as $400, and even more when very extensive. We make a novelty in book form consisting of a system which becomes secretive by the selection of a number. Such are sold at stores, and can be used by anybody."

At the office of Hatch & Foote, the bankers, a small cipher book was exhibited to the reporter. It contained names of stocks with orders to buy or sell, quantities, advice, etc., all to be represented by a word or two.

"There is nothing secretive about it," said Mr. Emmerson. "We give the books to our customers. It is a saving of money in telegraphing, and an easier and more certain way of communication. We have no need of a set cretive system in our general business, though the large operators use private codes."

This was on inquiry found to be the case, but any attempt to get a view of the private codes was regarded as the trick of a stock sharp.

Cashier Quinlan, of the Chemical Bank, pointed to a pile of books on his desk, and remarked that they were the cipher systems of various corresponding banks, and that much of the business communication between banks is being done by cipher. Banks generally get up a separate system for each bank with which they deal extensively. The cipher books are carefully guarded in the bank's vault, and even then code orders are verified back and forth by other code words, systematized for the purpose before a transaction involving much money is consummated.

Some houses having foreign connections and the steamship companies use very elaborate and extensive cipher systems. In such systems, over a cipher word column, it may read: "Can you secure —— bundles of hides and find room for the same on the next steamer? If so, telegraph us rates and particulars." At one side of the column of cipher words will be found a column of figures, running from one up into the thousands. The figures indicate the number of bundles or quantity, and the entire expression quoted above, together with the number of bundles referred to, may read simply "Bones." If the message "Bones" is sent from New York City to Melbourne, Australia, by the way of the Eastern route, it will cost $3, 40 cents being charged per word by the Atlantic cables, and $2.60 per word by the Eastern or India lines. Written out in full, the original 24 words would cost $72.

The Atlantic cables are more liberal in their treatment of ciphers than the land companies. The cables confine a word to ten letters generally, but accept of three cipher letters, whether they make sense or otherwise, for a word. That is, rxy or zbq pass as a single word. Three figures also count as a word, but when figures and letters are mixed—as, for instance, 6 qk or g 5 m—each letter and figure is charged for as a distinct word. This is done to prevent too great a liberty being taken with cable dispatches. Nearly all civilized nations, including China and Japan, and the nations of South America, permit messages to be sent and received in cipher. Russia and her dependencies are the exceptions. Telegrams to or from Russia, Bosnia, Bulgaria, Servia, Roumania, Montenegro, Herzegovina and Siberian points must be in open language, that the censors of the wires may read and investigate them at their leisure.

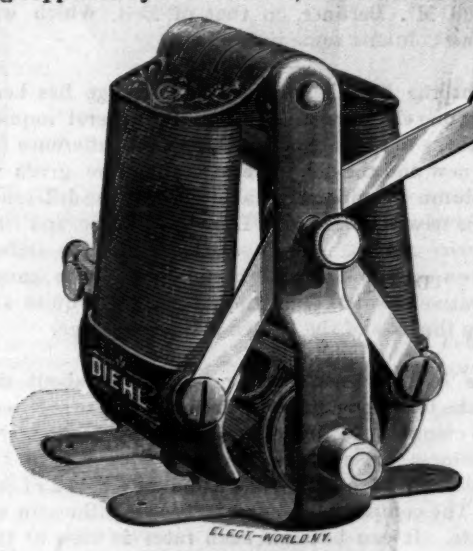
The most expensive all-wire message sent from New York city is one to some of the interior South American towns. The cost by direct cable and by way of the Eastern is $8.20 per word. To go by the coast lines and cables saves considerable on this rate; but when these lines are out of order the message has to take a transatlantic trip. But a message can be sent to distant Bosnia or Servia for only 52 cents per word, 40 cents of which is claimed by the cable companies. To reach Japan costs about $2.70 per word, and China the same amount. Khartoum can be reached at 95 cents; Turkey at $1 *via* Malta, or 54 cents *via* France. Messages to the various South American countries run from $1.40 to $3. Siam can be reached for $2.30 per word, and St. Petersburg for 58 cents.

In view of the figures given it will be easily understood why the commercial world takes kindly to cipher systems.

The Diehl Motor.

The demand for a small electric motor is now greater than ever, and has led to the construction of various forms, one of the most novel and ingenious of which is that shown in our engraving. This motor is the invention of Mr. Phillip Diehl, of Elizabeth, N. J., a number of whose other electrical inventions we described in the early part of this year. The present motor, though built on the same principle as the one exhibited by the inventor at Philadelphia, and illustrated by us at the time, differs considerably from it in construction and general appearance.

By referring to our engraving, it will be seen that the field-magnets are placed vertically and hinged at the top, being supported by two side rods, cast solid with the base.



THE DIEHL MOTOR.

The lower ends of the field magnets encircle the armature, which is also carried by journal bearings in the side rods.

The method of regulation of the motor consists in separating the pole pieces from the armature. This is accomplished by means of two connecting rods fixed to the lower ends of the magnets and joined together by a pin which slides in a slot on the upright. A rod connected to the pin serves to raise and lower the upper ends of the two connecting rods, and in doing so the field-magnets are separated or brought together, as the case may be.

When used in connection with a sewing machine, the motor is secured to the under side of the table in an inverted position, and the regulating lever connected to the treadle. In this position the field magnets fall apart of their own weight and the machine does not work. It is only when the treadle is pressed and the magnets are brought together that motion is obtained. It is evident that by varying the distance between the armature and the magnets any desired speed can be obtained for fast or slow work.

The motor is finished in a very ornamental style, and runs very smoothly.

The armature shaft is provided with a pulley, and its end is bored so that the power can be transmitted by belt or applied directly, as when driving a fan.

Electric Lighting in Guatemala.

The interests of the new illuminant are being actively pushed in Guatemala, for the capital.

The property of the works at Zapote is situated in the bottom of a deep *barranca*, about 800 feet below the level of the capital city. A stream of water about 20 to 22 feet wide and some 12 to 18 inches deep runs swiftly through the gully, and will supply the necessary power to two turbine wheels of a joint power of 150 horses. In consequence of the natural flow of water being insufficient of itself to continually supply the necessary force, it has been deemed advisable by Mr. Piatkowski, who has charge of the work, to construct two dams, one of which, the smaller or supplementary one, is already completed, and the larger one in a state ready for the reception of two immense supply pipes one, meter in diameter each.

The following is the explanation of the work as given by Mr. Piatkowski himself. "There will be six Thomson-Houston dynamo machines in the central station, each of which will furnish fifty lights of 1,000 candle-power each. There will be sufficient water stored in the reservoir formed by the dams during fourteen hours to run the dynamos to their full extent during the remaining ten hours. The large dam measures from its foundation 13 metres high, 26 metres long, 15 metres thick at its base, tapering to 6 metres at the top. The foundation, which is built on solid natural rock, measures 26 metres long by 18 metres broad. The water stored behind this dam will run through the pipes which supply the turbine wheels at the rate of 8 or 9 cubic metres per second.

The reservoir, when completed will be 700 meters long by 300 meters broad, having a depth of from 15 to 18 meters. The smaller dam which will act both as a safeguard against freshets as well as to form a supplementary reservoir which will greatly augment the force of the water at the lower dam. A small 40 or 50 horse-power turbine can be used here as well, capable of running 60 or 70 more lights.

There can be no idea formed of the amount of work and enormous expense necessary to perfect this great undertaking. Every single stone and brick had to be transported on the backs of "mossos" or peons a distance of three or four miles, 500,000 bricks and 30,000 arobas of lime having been thus far used, exclusive of that necessary to form the foundations. Roads had to be cut, rocks blasted, brush to be cleared and a thousand and one other details performed ere actual work on the dam and reservoirs could begin.

There are now about fifty lights burning in the city, the dynamo being run by a steam engine as a temporary arrangement until the turbines are ready for work. This department, together with the electrical apparatus at Zapote, is in the charge of Mr. Henry Argall, an experienced mechanical engineer.

The line and electrical work of the company is managed by Mr. B. T. Burt, the company's electrician, who has been specially sent out by the Thomson-Houston Electric Light Company, at the request of the Guatemala company. Mr. J. E. Asturias is the financial superintendent of the company. It will not be very long before the city of Guatemala will be fully lit up at night with the electric light.

Telephone Litigation at Memphis.

The bill filed at Memphis in the suit of the United States against the American Bell Company is as follows:

First—That Patent 174,465, on which the exclusive right to the "Broad Art of Telephony" was granted to Prof. Alexander Graham Bell, as the original and first inventor, and which is the foundation of the American Bell Telephone Company to said art, was obtained from the United States by false suggestion and fraud.

Second—That the Patent Office Examiner was deceived and imposed upon in procuring said letters patent.

Third—That important secrets were disclosed to said Bell by a Patent Office official, in direct violation of the act of Congress, which said Bell took advantage of in obtaining said exclusive grant.

Fourth—That said Bell was not the original and first inventor, and entitled, as such, to stand at the head of the "art." That his alleged invention was anticipated by others, and well known by the learned and scientific long prior to his alleged discovery.

Fifth—That he knew he was not the original and first inventor.

Sixth—That he, nevertheless, falsely made oath that he was such original and first inventor, and by suppressing the truth, by false suggestion and contrivance, he procured said letters patent.

Seventh—That said Bell's description of his alleged invention is fatally defective, and the alleged invention itself, without other discoveries and inventions on the art, is wholly valueless.

Eighth—That as early as 1862 the electric-speaking telephone was known and publicly used by Philip Reis, the true inventor, who made various improvements on the art between that date and his death, which occurred in 1874, and that he successfully put his invention to the test by actually transmitting and delivering articulate speech. That said Reis not only invented the art, but named the machine for its use "*the telephone*."

Ninth—That others made improvements on the art and successfully employed it after its discovery and prior to the alleged invention of said Bell. That said Bell well knew the existence of the art and the state of the improvements thereon at the time of his alleged invention, and obtained his patent by concealing the fact and imposing on the Patent Office.

Tenth—That if he had fully and truthfully disclosed what he knew on the subject, he could not have obtained the said patent.

Eleventh—The broad art belongs to the public because anticipated by others, and the monopoly claimed and enjoyed by the American Bell Telephone Company by reason of the said grant is unjust, wrong and oppressive to many improvers on that art, whose discoveries are covered by letters patent from the Government, as well as to the people at large of the United States.

Twelfth—That a grant so obtained should be recalled, repealed and vacated, and, accordingly, the bill prays that the said patent be recalled and repealed.

The Underground System of the Okonite Company.

Of the many devices shown and explained to the New York Underground Wire Commission there are comparatively few which show real merit in their design, and many seem to have attacked the problem on very limited knowledge of the necessities of the case. Thus, quite a number have entirely ignored the question of easy connection between different lines and sacrifice everything to insulation. Among the plans submitted, by which the necessity of a conduit is obviated, that of the Okonite Company, of this city, deserves mention on account of originality, both as regards method and apparatus.

The system, which is the invention of Mr. J. J. C. Smith, the superintendent of the company, contemplates the use of a specially constructed cable which can be laid down very cheaply. The remaining part of the system, and by no means the least important, consists in the method employed in connecting the various lines, both among themselves and with the buildings to which they are run.

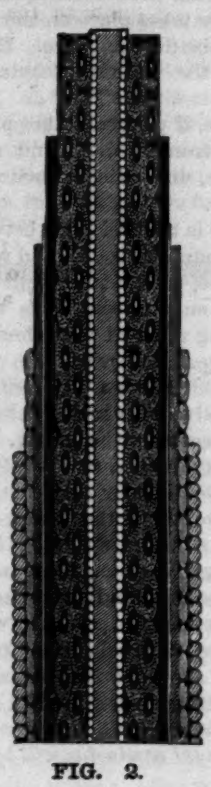


FIG. 2.

Beginning with the cable, we find it constructed in an ingenious manner so as to meet the special requirements to which it is subjected. Our illustrations (Figs. 1, 2 and 3) show respectively cross and longitudinal sections of it, Fig. 3 exhibiting the various layers and armoring. The core of the cable is formed by winding a copper wire in a close spiral so as to resemble a continuous tube when finished. Aroun d this central tube are wound the conductors, which are each insulated with okonite and braiding. The conductors in turn are surrounded by a thick layer of okonite, over which is a covering of lead or tin-foil. The whole is then well taped.

Over all this the armoring is wound. It consists of two layers of iron wires. The first of these comprises a number of wires wound in long spirals; the second and outermost armor, however, consists of a single large wire wound in a close spiral. When thus complete, the cable is placed in a vulcanizer, and while hot, melted ozokerite is forced into the central core under pressure. It passes through the sides of the copper spiral and fills up all free space between the conductors and the layer of okonite. It also fills the central tube, leaving a core of solid ozokerite. The object attained by this method of armoring is a very great flexibility, for a cable containing 55 telephone conductors can easily be bent to a radius of two feet. The double armor also prevents mechanical injury, which must evidently be provided for in an underground cable.

FIG. 4.—THE UNDERGROUND SYSTEM OF THE OKONITE CO.

We now come to the method of inter-communication between and distribution of the conductors. For this purpose the device shown in the accompanying engravings is provided. The "connection box" employed is shown in perspective in Fig 4, and in section in Fig. 5. It will be seen to consist of a base *A*, an upper section *B* and a cover *C*. The upper section will be seen to contain five division cases, in which the five cables entering the base terminate.

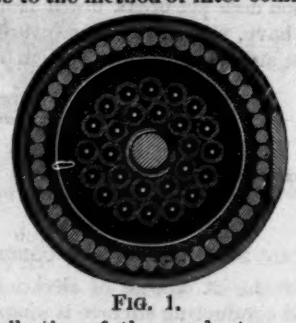


FIG. 1.

The division cases consist of square boxes, with a hard rubber top, into which a number of brass studs are fixed. As shown in Fig. 6, the ends of the conductors are permanently attached to these studs; the cases are then filled with melted ozokerite or asphaltum, which insulates them effectually and keeps out moisture.

Connection from one conductor to another is made by means of a flexible insulated cord, provided with thimbles which fit the studs in the connection boxes. After the proper connections have been made, melted asphaltum is poured into the upper part to the depth of about one inch, so that it partly surrounds the lower end of the division cases. This excludes all possibility of water entering from underneath. The cover *C*, which is level with the street surface, is then screwed down with bolts, and a packing gasket excludes water from above.

These junction boxes are placed at the intersection of two streets, and the four outer cables led in each direction to other similar boxes. The fifth, or central cable, however, is run to the basement of an adjoining corner-building, whence the wires needed in that block can be distributed as required.

FIG. 3.

From the description it is evident that by means of the studs and the flexible cords the conductors of one line may be connected or branched off in any direction, or by the central cable they may be put in connection with every building on the block.

The system we have just described shows careful working out and removes many objections which have been urged against underground wires.

THE recent action of the New York Underground Commission, in refusing to allow some new electric light wires to be strung, even in comparatively unimportant streets, must have the effect of compelling the various electric companies giving service in New York to make up their minds as to what course they will pursue, what system they will adopt, if any, and the Okonite Company is of opinion that its plan affords a very timely solution of their difficulties.

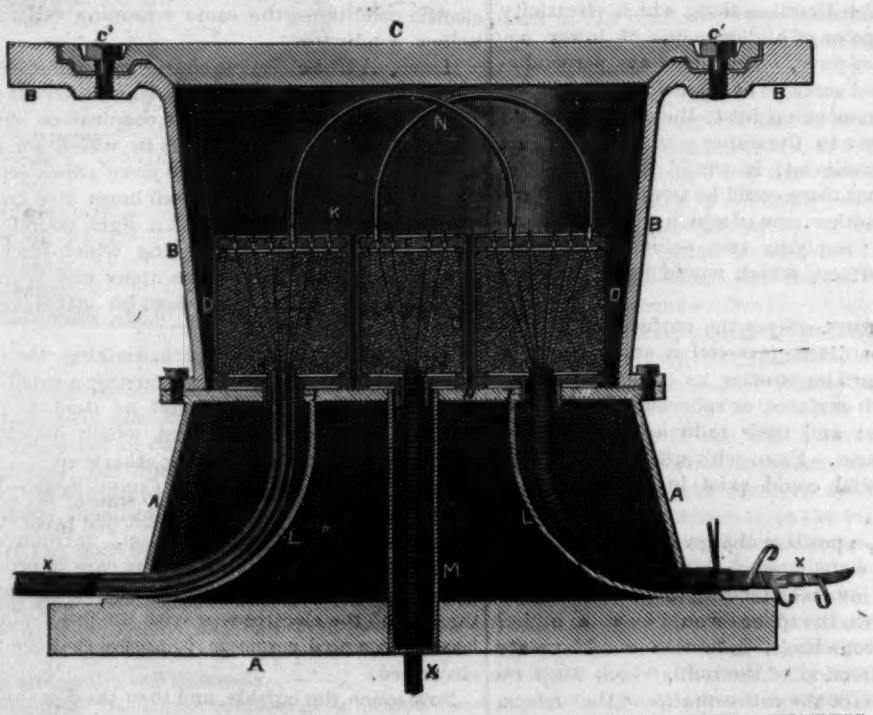


FIG. 5.

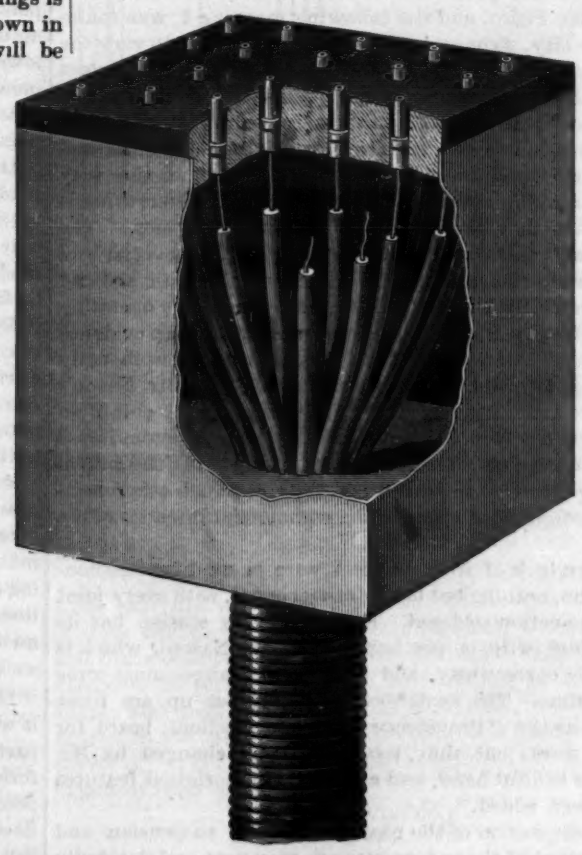


FIG. 6.

THE UNDERGROUND SYSTEM OF THE OKONITE CO.

Telephony in Santo Domingo.

BY W. J. FERRIS.

In compliance with the request of THE ELECTRICAL WORLD for a little sketch of my trip here, I would say that from New York to Turk's Island was a slow and tedious run, occupying five days, and upon shore I could find nothing but salt, salt, salt. From Turk to Cape Hayti was but a night's run. Thence to Puerto Plata was another night's run, and here I set foot upon the soil of Santo Domingo. Puerto Plata (Silver Port) is a quiet little city on the north coast of the island, some two hundred miles distant by land and four hundred by water from Santo Domingo City, the point of my destination.

Hearing of a telegraph office that had just opened for business, I started to hunt it up. Not seeing any wires and being unable to speak Spanish, I made but slow headway. "Fortune favors the brave," however, and after a struggle I found the coop and squeezed in. It is the slimmest affair in the telegraph line I ever saw. The line just completed is owned by a French company and runs only to Santiago, about a hundred miles into the interior and over mountains several thousand feet above the level of the sea.

The system in use is a French printing one, and is operated by a Frenchman, who has the regulation small boy to interpret for whoever calls. From the "lay out" in the office, I concluded it was not a very profitable affair. Later I took a look over the single line running through the city, and found it very inferior in construction to those in the States.

The poles were very small, short and crooked, and stood out in every direction like the quills on the fretful porcupine. The brackets in nearly every instance were on the wrong side, and the wire so slack in many places that one could touch it with a cane. This style of work made me so homesick that I desired a speedy return to New York, and I was only too glad to take my departure from Puerto Plata.

Another night's run brought us to the famous Samana Bay, the spot which the late lamented General Grant wanted for a United States military station, and if our people could have known more of this matter at the time, they would have given hearty support to the great chieftain's enterprise.

Leaving Samana, we rounded Mona passage and entered the Caribbean Sea, making the first stop on the south side of the island at Macoris, an important sugar-shipping point that may become the future great city. Just before sunset of the same day we turned from the Caribbean Sea and entered the Ozama River, passing at its mouth several grand old ruins of forts, castles, etc., which were constructed long, long ago, when Christopher Columbus was here in his glory. The scene coming up the river was one of great beauty and ended much too soon, for it was only a half mile or so to the landing. It was now Monday evening, Aug. 10, making the trip just eleven days from New York. It took but a moment to find General Manager Nason's office, for the building loomed up away above all surroundings.

Comfortable quarters had been secured for me at the Hotel San Pedro, and the following morning I was taken over the city, sight-seeing; but more especially to view the plant put in by Mr. Nason, and I can say that more perfect and substantial construction seems impossible. The "juniper" poles are tall, straight as an arrow and well lined, and, laden with their many bright cross-arms and glistening insulators, contrast prettily with the very peculiar architecture of the city buildings. Everything is being done in a first-class and thorough manner. The "central" is located at the corner of Commercial and Mercedes streets, in a new five-story addition, designed and constructed by Mr. Nason. The cable house, the operating room, the adjusting and other departments, are an evidence that the general manager knows his business. The other city buildings are only one or two stories high, and Mr. Nason's idea of constructing the building so high was to obtain an unobstructed view of the sea, harbor, river, custom house wharf, docks, etc., for the purpose of reporting the arrival and departure of steamships, vessels and such other matters as might be of value to the commercial interests of the city.

Not an inch of iron or steel wire is used for line construction, nothing but hard-drawn copper, with every joint and connection soldered. Each and every station has its individual wire (a pet hobby with Mr. Nason), which is the only correct way, and what all exchanges must come to in time. The switchboards so far set up are those known as the "Providence"—a most excellent board for quick work, but they, too, have been changed by Mr. Nason's skillful hand, and a few new and original features have been added.

The suspension of the receiver and the suspension and adjustment of the transmitter are very neat and decidedly ingenious. The latter is suspended with the Nason anti-vibrator, and it is adjustable to right or left angles by the mere touch of the finger.

There are other and more important features, but I am not at liberty to write of them in detail. The strangest thing of all is that I have come from the very fountain head of the business, to a comparatively wild country, to find inventions and improvements in the telephone line that seem to me to be far ahead of anything I had previously seen in the States. I refer to nearly everything, but more especially to the full set of telephonic instruments designed by and constructed under the direction of Mr. Nason, who dissected a set, a night or two since, for my special benefit.

The cabinet work of one style is of solid mahogany throughout, even to the back board, and of the highest order of finish; and while it is of the same general shape as the Bell Company's "Standard," it is more compact and much neater, and the multitude of binding posts and connecting wires (such a source of trouble and depository for dust) are made conspicuous by their absence, which is a godsend to the inspector.

A simple little contrivance is placed within the top of the magneto which cuts out the whole instrument, if so desired, during thunderstorms, no plug being used.

The adjusting of the bells is done from the inside in a simple and positive manner. The automatic shunt, attached to the crank arbor, is so delicate in its operation that it cannot be felt by the hand—is absolutely without "back kick"—and yet the make and break, or rather the break and make, of contact is very positive. The battery and instrument switch is operated with one-tenth the usual weight required, yet it cannot stick or "hang fire" at any point, as the action of the lifting spring increases in power, to a certain point, as the switch rises.

No wires show on the transmitter boxes, and the latter are suspended upon the "Nason anti-vibrators," which are also out of sight and are a success.

The transmitter case is without a concave opening to speak into, but has instead a metallic resonator of most simple construction that, in combination with the anti-vibrators, gives a very loud and exceedingly clear tone to the articulation.

The receiver used is of novel construction, and reproduces the maximum of the force absorbed by the transmitting instrument.

Mr. Nason has shown me many other things in the telephone line which are new to me, but to speak of them in detail would more than exhaust my time and your patience.

The above is sufficient, at present, to show that Santo Domingo is not only not behind in telephonic matters, but perhaps, marvelous to tell, a little ahead in the march of progress.

Certainly the affairs of the Domingo Electric Company have been exceedingly well launched, and if General Manager Nason does not break down from overwork, this country will have, within the near future, a complete network of wires and a telephonic system unequaled in the world.

Static Electricity.

BY PHILIP ATKINSON, A. M., PH. D.

CHAPTER V.

ELECTRIC DISTRIBUTION AND CONDENSATION.

EQUIPOTENTIAL.—A charge of electricity given to any part of a good conducting surface is instantly distributed equally over every part, and such a surface is called *equipotential*. For the momentary increase of electric energy at any point creates electric movement from higher to lower potential, which instantly results in the establishment of equilibrium at every point.

Separate points on such a surface are called *equipotential points*, and a line of such points *an equipotential line*.

LINES OF FORCE.—The direction along which electricity tends to move from a point of higher to one of lower potential is called *a line of force*. Such lines are perpendicular to the equipotential surfaces at the points; for, as the tendency is to move from one point to the other, it would be from one such surface to the other; and, if the line differed from a perpendicular, it would imply, by the resolution of forces, that there could be two lines of force at right angles to each other, one of which would lie in an equipotential surface; implying two points at different potentials in such surface, which would be an impossibility.

SURFACE CONDENSATION.—Since the surface of a solid sphere of any good conducting material is evidently equi potential, we may regard its interior as composed of an infinite number of such surfaces, or spherical shells, having a common centre; and their radii as equipotential lines cut by such surfaces. From which it is evident that no difference of potential could exist in the interior of such a sphere.

If it were insulated, a positive charge communicated to it would evidently be distributed equally through every part, if there were no influence tending to produce a different effect. But, since the sphere would be at a higher potential than its surroundings, induction would create lines of force in the direction of the radii, which must result in the condensation of the entire charge on the surface.

Also, since every portion of the sphere is at the same potential, and since electrified bodies at the same potential repel each other, it is evident that the molecules would be self-repellant. But since they are rigid, the electricity of each molecule would repel that of every other, and move in the direction of least resistance. Let a row of molecules composing a diameter be selected, the direction of least resistance would be from the centre each way. For, if surface condensation takes place (and experiment shows that it does), as the electricity of the molecules near each end of the diameter became condensed at the extreme points, its reaction being thus neutralized, more would be repelled from the centre, and this would continue till all the electricity of the diameter was condensed at the ends.

But since the ends are points on the surface, and the surface is made up of an infinite number of such points, it is evident that the entire charge would be condensed on the surface.

Hence surface condensation takes place under the influence of attraction from without and repulsion from within, in the direction of the radii.

If the charge be negative the potential of surrounding bodies, being higher than that of the sphere, electricity is, in like manner, repelled from the surface toward the centre; and the negative charge takes place on the surface as the positive charge did in the first instance. Hence the condensation is now in the interior, leaving the surface negative.

Hence surface charge, if positive, takes place under the influence of attraction from without and repulsion from within; but, if negative, under the influence of repulsion from without.

In either case the air is the dielectric between the electrified sphere and surrounding bodies, and when the charge on the sphere is positive, a negative charge of corresponding amount is induced on adjacent parts of surrounding bodies; electricity being repelled from them by the higher potential of the sphere. But when the charge on the sphere is negative, the charge on adjacent parts of surrounding bodies is positive; electricity being attracted to them by the lower potential of the sphere.

Now since surrounding bodies, as a whole, are at zero, and this positive charge, in their adjacent parts, results from the negative attraction of the sphere; it is evident that the interior potential of the sphere, as a whole, cannot rise above zero; the negative potential of its surface being exactly equal to the positive of adjacent parts of surrounding bodies, just as their negative potential was equal to the sphere's positive surface potential in the first instance.

Now, since a solid of any conceivable shape could be cut from such a sphere without altering the electrical conditions named, it is evident that, *A charge of electricity communicated to any solid conductor will be condensed on its surface.*

SURFACE TRANSMISSION.—It is also evident that although a static charge will be thus condensed on the surface, electricity is not confined to surface transmission, since surface condensation is due to induction and repulsion, which implies the possibility of transmission through the substance to reach the surface.

Hence, although induction operates during transmission, it cannot prevent transmission through the substance, so that it must not be inferred that the conducting power is in proportion to the *surface*, but to the *mass* of the conductor.

Hence a charge of electricity which could be easily transmitted by a solid rod, might be sufficient to melt a thin tube of the same diameter.

HOLLOW CONDUCTORS.—The same reasoning which applies to an electric charge on a solid sphere will also apply to one on a hollow sphere. For if any number of the spherical shells composing the interior be removed, it does not alter the equipotential of the remaining ones, nor of their radii; neither can it change the induction of the outside surroundings.

And as the form may be altered, without changing the electric conditions, the same reasoning will apply to any hollow conductor.

Hence, *A static electric charge communicated to a hollow conductor will be condensed on its external surface.*

PROOF PLANE.—But all our conclusions should be the result of experiment; to aid us in which we now require the little instrument called the *proof plane*, represented in Fig. 8, which consists of a small brass disc two inches in diameter, to which is attached a light ebonite handle, 12 inches long. A light, flat spring which lies close to the disc, its lower end free and its upper end attached to the handle, will be found convenient for attaching tin-foil in some experiments.

The proof plane is used for examining the electric condition of bodies, and for transferring a small charge of definite amount. Care should be used to prevent the handle from becoming charged, which may happen from friction against the clothing or otherwise.

EXPERIMENTS WITH HOLLOW CONDUCTORS.—Let a charge of electricity be given to the insulated sphere *A*, Fig 9; which has an opening in the top. Introduce the proof plane through this opening, taking care to prevent contact with the edges; and touch the inside surface, and then the disc of the electroscope with the proof plane. As the leaves show no divergence, it proves that the inside is not electrified.

Now touch the outside, and then the disc, and the leaves diverge; proving that the charge is on the outside surface.

Apply the same tests to the insulated cylinder *B*, and the same results will follow. And this cylinder may be composed either of sheet metal or wire gauze without affecting the results.

Cylinders of the latter kind are often used to protect electroscopes from the induction of electrified bodies in their vicinity.

Repeat these experiments, communicating the charge to the inside surfaces of the globe and cylinder, and the results will be the same; showing that no charge can remain on the inside.

BAG EXPERIMENT.—To test this more thoroughly, Faraday constructed a cone-shaped linen bag, shown in Fig. 10, attached to its mouth a ring, insulated on a stand, and to its apex, two silk cords, by which either surface could be turned outward.

All electric charge was communicated to it, and on testing with proof plane and electroscope, was found to be entirely on the outer surface. The surfaces were now reversed, and the charge was found to have been reversed also, going to the outside, as before.

PAIL EXPERIMENT.—The following experiment by Faraday shows the effect of induction on a hollow conductor:

Let a tin pail *A*, Fig. 11, or any similar hollow conductor, be insulated and connected by a wire with an electroscope *E*, and let an electrified metal ball *B* be lowered into it by a silk cord. The leaves will diverge as the ball enters, and the divergence increase till the ball has passed some distance below the edges, after which the divergence is not increased by its further descent.

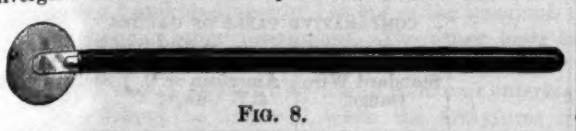


FIG. 8.

If it be lifted out without having touched the pail, the leaves will converge, and the ball show no loss of charge; but, if allowed to touch while below the edge, the leaves will remain divergent after its removal, but show no increase of divergence by the contact, and the ball, after removal, will be found entirely discharged.

This experiment proves:

1. That the induction of the electrified ball has repelled electricity from the inner to the outer surface of the pail, if the charge was positive, or attracted electricity from the outer to the inner surface if the charge was negative; in either case producing a divergence of the leaves.

2. It proves that induction increases as the ball descends, shown by the increasing divergence of the leaves, till all the lines of force, which can be included within the pail, are cut by its surface, after which there is no further increase of divergence.

3. It proves that there is no permanent effect if there is no contact, since the leaves converge when the ball is removed.

4. It proves that the induced charge on the pail is exactly equal to the charge on the ball, since no

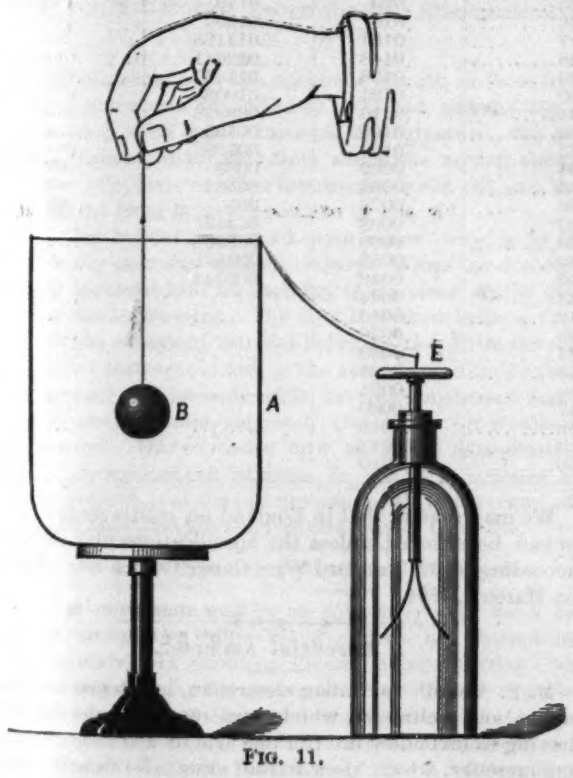


FIG. 11.

increase of divergence occurs from contact, although the entire charge has been communicated to the pail, as shown by the ball having lost its charge. But this can be strictly true only when all the lines of force are cut by the pail; but since some of the nearly vertical lines must escape, no matter how deep the ball descends, there must be a slight increase of divergence by contact, though it may not be perceptible.

If a charge be given to the pails and the ball be lowered into it by a wire held in the hand, the divergence of the leaves, caused by the charge on the pail, will be perceptibly reduced as the ball descends.

This proves that the inner surface of a hollow conductor can be charged by induction. The charge on the pail, if positive, repels electricity from the ball, through the wire and hand, to the earth; or, if negative, attracts electricity from the earth: and in either case, a certain degree of equilibrium follows, causing a corresponding convergence of the leaves.

Entire convergence cannot be produced, since only a small portion of the lines of force from the pail are cut by the ball; while, in the former experiment, nearly all those from the ball were cut by the pail. For this reason a large ball is best for the second experiment and a small one for the first.

If the ball, in the second experiment, is lowered by a silk cord instead of a wire, there is no perceptible effect on the leaves, since induction cannot increase or diminish the electricity of the ball when there is no earth connection.

COMBINATION OF PAILS.—The following experiment was made by Faraday with a combination of hollow conductors

Let four pails of different sizes be placed on an insulated support, and arranged one within the other as shown in Fig. 12; and let them be insulated from each other at bottom by cakes of paraffin or any other good insulator, placed between them. Let silk cords be attached to the three inner ones, and the outer one be connected with an electroscope.

On lowering the charged ball into the innermost one, the leaves diverge as in the first experiment; contact between the ball and pail producing no increase of divergence, and the ball is then found to be discharged, as before; which proves that the interposition of the insulated pails, 2 and 3, has not affected the induction.

Now let pail No. 4 be lifted out by the silk cord, and the leaves will converge, and diverge again when it is replaced, showing that the charge on the ball was transferred to it.

Let a connection be now made by pieces of copper wire, let down by silk threads, between each of the pails successively, beginning with 4 and 3, till all four are in electric connection, and let the effect on the leaves be observed as each connection is made. The result will be found the same as in the first experiment, when but one pail was used, which proves that neither the interposition of interior surfaces—when they are insulated—nor increase of charged surfaces—when the surfaces were connected—has any effect on induction; nor can it prevent the entire charge from going to the outside surface when the four pails are in electric connection; for if the three inner pails be now removed, they will be found to have lost their

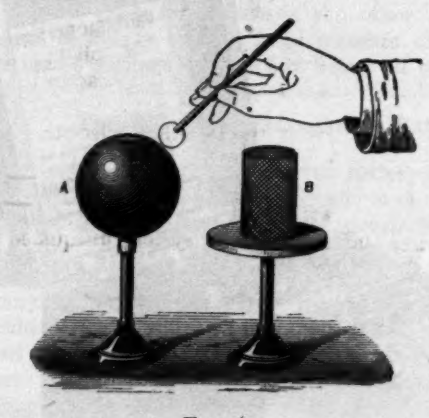


FIG. 9.

charge; but there will be no change in the divergence of the leaves.

This experiment is an actual demonstration of what has already been stated on pages 86 and 89, that the interior of a solid conductor, or the shell of a hollow conductor, may be regarded as composed of an infinite number of equipotential shells or surfaces, from which a charge of electricity must always pass to the outside surface.

FARADAY'S HOLLOW CUBE.—A most remarkable experiment in this connection was made by Faraday with a hollow cube of wood, 12 feet each way, covered with tinfoil, insulated and charged by a powerful electric machine.

He says: "I went into this cube and lived in it, using lighted candles, electrometers, and all other tests of electrical states. I could not find the least influence upon them, or indication of anything particular given by them, though all the time the outside of the cube was powerfully charged, and large sparks and brushes were darting off from every part of its outer surface."

This experiment verifies the statement made on page 24 in regard to zero potential; showing that however strong the electrification, no indications of electric action are perceptible within a space where there is perfect equilibrium.

So that even if the whole earth were as powerfully charged, in proportion to its size, as Faraday's cube, we, who live on it, could perceive no electric action, if the charge were as uniform as on the cube.

But if it be objected that the case is not parallel, seeing that we live on the surface, it must be remembered that we have an atmosphere above us which is a part of the earth's matter; so that, although we live on the *solid* surface, we do not live on the *outer* surface, and the surface on which we live is practically equipotential over limited areas. So that the result in regard to potential is practically the same as on the outer coating of a Leyden jar.

Faraday, evidently, might have generated electricity with insulated instruments, inside the cube, and condensed it on insulated conductors without disturbing the electric conditions by which he was surrounded, or being prevented by them, just as we do without disturbing the earth's electricity or being prevented by it. But any connection by a conductor between his instruments and the cube would have caused the charge to disappear, just as a similar connection with the earth produces the same result.

THICKNESS OF ELECTRIFIED SURFACE.—The idea of surface condensation implies that an electrified surface must be something more than a mere superficies. It must have a certain degree of thickness, the electricity penetrating the conductor and surrounding air to a certain depth, in proportion to the resistance of the air, and the attraction or repulsion of the charge on the conductor.

Hence the amount of static charge which may be condensed on a conductor per unit of surface depends on the resistance of the air.

CONVECTION.—It has already been shown that dry air is one of the best insulators; but, since it is a fluid, its resistance cannot be so great as that of a solid of the same insulating power; for the air molecules, in contact with an electrified surface, becoming charged, fly off under the influence of repulsion and induction, while those farther out rush in to take their place, creating air currents around the conductor, by which its electricity is gradually dissipated. The removal of electricity by the air in this way is called *convection*.

VARIATION OF CHARGE.—Since the insulating power of the air varies greatly with its humidity and temperature,

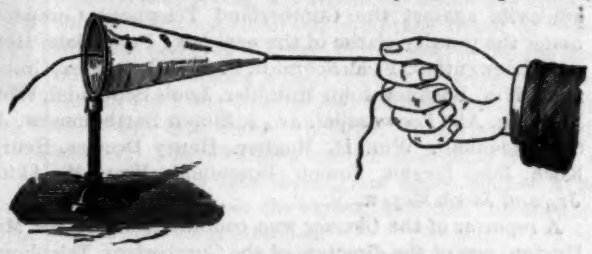


FIG. 10.

and since its electric potential is also variable, the charge which may be condensed on a conductor will vary in like proportion; dry, cold air being much more favorable to the condensation of a high charge than damp, warm air, and air at a high electric potential than air at a low potential.

Analogous to this is the influence of atmospheric pressure on steam; the temperature varying with the pressure under which it is generated. Here *pressure* constitutes resistance, while in the case under consideration the resistance is due to the causes mentioned.

Equal electric condensation on every part of the surface is never practically true, as the induction of surroundings varies, and form, as will be shown hereafter, has an important influence. It could only be true of an insulated

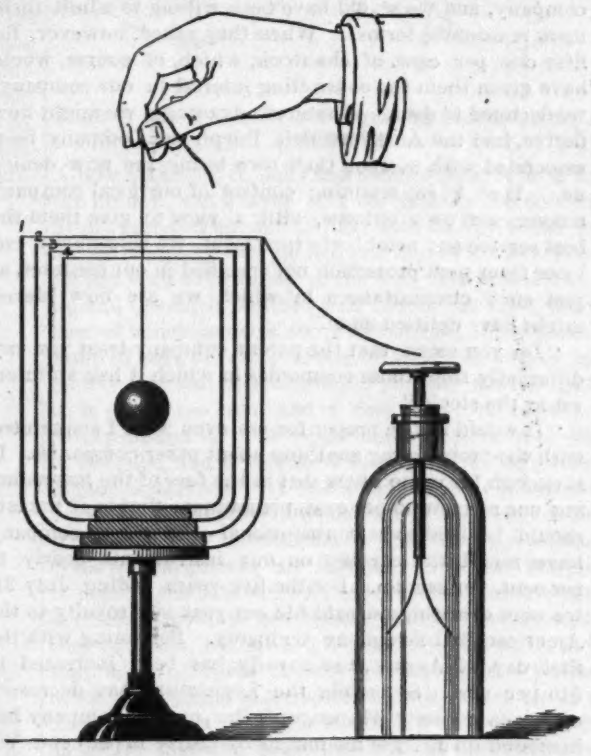


FIG. 12.

sphere, surrounded by a homogeneous medium, and removed from all other influences.

INFLUENCE OF FORM.—It has already been stated that form exercises an important influence on the amount of static charge which may be condensed on a conductor, and that a charge on an insulated sphere is equally distributed over its surface when the surrounding induction is equal; also that the air, by its insulation, retains this charge on the surface, and by its convection gradually removes it. It is evident also that these forces act at equal distances from the centre.

(TO BE CONTINUED.)

On a Margin.—A prominent stock commission merchant on Wall street received an order over his private telegraph wire from Chicago to purchase three shares of a certain stock. The broker received a commission of six cents for executing this order, but his expenses in doing so amounted to five cents, so that the total profits on his transaction amounted to only one cent. This illustrates the narrow margin on which stockbrokers do business.—*New York World.*

The Telephone in Indiana.

When the Cumberland Telephone Company presented their bill to the firm of Vickery Brothers, at Evansville, Ind., for collection, these gentlemen offered to pay the amount under the condition that the company should state on the receipt that $2 of the $5 was paid under protest. The telephone company refused to do this, and on the refusal of the firm to pay under any other conditions the instrument was removed. The firm, composed of Messrs. Samuel Vickery, Elder Cooper, William W. Vickery and George S. Vickery, then brought suit against the Cumberland Telephone and Telegraph Company to compel them to give them telephone service at the rate of $3 per month, as specified by law, that collections be made at the rate of $3 per month and receipted for.

This was the first suit of the kind entered.

It will be remembered that the County Commissioners have refused to pay more than $3 per month for the use of the instruments in the county offices. The company have not yet removed these instruments, and the question that arises is, will the company remove them and thus involve themselves in another suit?

The following parties at Evansville, Ind., have also filed affidavits against the Cumberland Telephone Company under the penalty clause of the new law: Peter Balz, Herman Loewenthal, F. E. Schmidt, P. J. Felker, Alex. Crawford, Wm. Boehme, John Mutchler, Louis Schmadel, Wm. Koelling, Abe Loewenthal, Jr., 2; Simon Bartholomew, J. C. Mendenhall, Wm. H. Magher, Henry Drewes, Henry Koch, John Ziegler, Joseph Rosenfield, Wm. M. Akin, Jr., and Jacob Meyer.

A reporter of the *Courier* was commissioned to see Mr. Huston, one of the directors of the Cumberland Telephone Company, and inquire of him if the company desired to make public a statement of its position relative to suits at law, civil and criminal, now pending against it. At first Mr. Huston declined to say anything; but later, having reflected upon the proposition, he expressed his willingness to talk, with the view of setting the public right as to some misapprehensions under which he claims it labored.

"I do not think the people understand," he said, "the attitude of the Cumberland Telephone Company and its relation with the American Bell Telephone Company. To begin with, the American Bell Telephone Company does not own a dollar stock in our company, although, I believe, our company is the only one, or at least one of the very few, of which this statement may be truthfully made. The parent company wanted to become stockholders in our company, and we would have been willing to admit them upon reasonable terms. When they asked, however, for fifty-one per cent. of the stock, which, of course, would have given them the controlling interest in our company, we declined to deal, Whatever advantages we might now derive, had the American Bell Telephone Company been associated with us upon their own terms, are now denied us. That is, in retaining control of our local company among our own citizens, with a view to give them the best service and neighborly treatment, we voluntarily cut loose from such protection not specified in our contract, as just such circumstances in which we are now placed might have entitled us to."

"Do you mean that the parent company treat you any differently from those companies in which it has an interest in the stock?"

"It would not be proper for me, even were I acquainted with the facts, to say anything about other companies. It is enough for me to know that in the face of the law reducing our receipts 40 per cent. per annum—that is, if the law should be held to be constitutional—the parent company have raised the royalty on our instruments nearly 15 per cent. per annum. For the five years ending July 31, we were charged and paid $14 per year net royalty to the American Bell Telephone Company. Beginning with the first day of August, the royalty has been increased to $16 per year. So, while the Legislature has decreased our gross receipts 40 per cent, the parent company has increased its charges against us by nearly 15 per cent. We are thus placed between two fires, and unless there is a remedy it will be impossible for us to continue business unless we can get another telephone. Just now there does not seem to be any prospect of this. There are several other telephones with which good service could be given, so I understand, but as yet none of them have been able to withstand the adverse litigation of the American Bell Telephone Company. There is no other telephone working an exchange successfully that I know of."

"What is the history of the Vickery suit?"

"After the passage of the three-dollar law, acting under the advice of counsel, we determined to render each month an itemized bill, amounting in the aggregate to five dollars per month, for transmitter, telephone and attachment. Where the subscriber desired, as many of them did, to indorse on their bills, 'two dollars of this sum paid under protest,' we permitted it to be done. Vickery Bros. wished to make a different indorsement, to the effect that the two dollars were paid contrary to law. We could not permit this without manifestly admitting away our entire case. We said to Mr. Vickery: 'We cannot afford to serve you for less than five dollars per month without suffering loss, and, therefore, unless you are willing to pay that amount, we cannot do business together.'

"What about the criminal suits instituted against the company?"

"I don't know. I suppose the prosecuting attorney has done this in pursuance of his idea of his duty, and it is not my province to criticise him."

"What will you do if the courts decide against you?"

"If the courts should decide the law constitutional, I do not see how we can avoid discontinuing business, unless we can get very considerable concessions from the American Bell Telephone Company, or unless we can get another telephone whose right to operate is clear and undisputed, a contingency not likely to arise for many years to come. I have said that we pay $16 per year for every telephone in the Evansville exchange, but this is not all we have to pay. When the Bell and Edison Telephone companies consolidated, the Edison company was assigned the long circuits between towns within a radius of one hundred miles, the Bell company being assigned the exchanges in the town and cities. Under the provisions of this consolidation, therefore, we are compelled to pay, in addition to the royalty on telephone, 35 per cent. of the gross receipts from intermunicipal business."

Mr. Huston expressed an earnest desire to conform to the law, and said that the litigation now pending was, to say the least, in bad taste, as all the questions at issue between the telephone companies and their subscribers were now before the Supreme Court, in five different cases submitted upon an agreed statement of facts. He thought it would have been more courteous and neighborly to have awaited the decision in those cases, as the company would have to make restitution of all overcharges should the court sustain the constitutionality of the three-dollar law.

A New Medical Battery.

Our illustration below shows a new medical battery, the "Universal," manufactured by the Detroit Electrical Works, Detroit, Mich. This battery is 7½ in. square, outside dimensions. The metal parts are brass, nickel-plated. The case is made of cherry wood highly polished. No connections are necessary in order to start the battery, the elements being simply lowered into the fluid. The acid does not need to be removed from the cell in handling the battery, as the cell is hard rubber and has an air-tight covering. Directions for use are given on the cover of each case. The works make also a "Pocket Universal" battery, 4½ × 7 × 2. Both are cheap, handy and durable.

NEW MEDICAL BATTERY.

The Telephone in New England.

Lowell, that was wildest to buy telephone exchange stocks on the telephone craze, is now loudest in denunciation of everything telephonic. The Lowell papers are exploding columns against the Bell Telephone Company, and a telephone subscriber in the Lowell *Mail* says: "The American Bell Telephone Company must put the management of the New England Company into the hands of people that are the people. Stop this raising of rates. Cut this enormous expense of management; and waive any claim of the American Bell Telephone Company to dividends on this watered $6,000,000 of stock, and pay the holders of the balance of the stock the return for their money that they are entitled to. This action would entirely abolish all unfriendly feeling against the telephone business as a whole; would increase the number of subscribers, and prevent any unfriendly action by the coming Legislatures of Massachusetts, New Hampshire and Vermont, which is sure to come if the outrage is allowed to continue."

"It is a little hard," says the Boston *Transcript*, pertinently, "that the Bell Telephone Company should pocket in royalties all the profit there is in the telephone exchange business, have the control and management of the company, a majority of the stock, and yield up no returns to the people whose money paid for the telephone exchange plants throughout New England. We believe that the gentlemen connected with the American Bell Telephone Company see this very clearly; [but the first step toward its correction must be the placing of the smaller telephone exchanges upon a paying business, and to this end the rates must be advanced in the towns and smaller cities, and while they are being advanced, the American Bell Telephone Company is making concessions in its royalty charges. In the end, the royalty profit to the Bell Company will be less and the dividend profit more, and then affairs will be pleasanter all around. But the rates must go up."

The Standard Wire Gauge.

The recent adoption of the British Standard Gauge by the National Telephone Exchange Association is the first step in a movement toward uniformity, which has long been desired among electricians. We give the following comparative table of the new standard and the older ones:

COMPARATIVE TABLE OF GAUGES.

	Standard Wire Gauge.	American or B. & S. Gauge.	Stubs or B. W. Gauge.
No.	Diameter.	Diameter.	Diameter.
7o	.500	.....	....
6o	.464	.....	....
5o	.432	.....	...
4o	.400	.460	.454
3o	.372	.40964	.425
2o	.348	.36480	.380
0	.324	.32495	.340
1	.300	.28930	.300
2	.276	.25763	.284
3	.252	.22942	.259
4	.232	.20431	.238
5	.212	.18194	.220
6	.192	.16202	.203
7	.176	.14428	.180
8	.160	.12849	.165
9	.144	.11443	.148
10	.128	.10189	.134
11	.116	.09074	.120
12	.104	.08081	.109
13	.092	.07196	.095
14	.080	.06408	.083
15	.072	.05706	.072
16	.064	.05082	.065
17	.056	.04525	.058
18	.048	.04030	.049
19	.040	.03589	.042
20	.036	.03196	.035
21	.032	.02846	.032
22	.028	.025347	.028
23	.024	.022571	.025
24	.022	.0201	.022
25	.020	.0179	.020
26	.018	.01594	.018
27	.0164	.014195	.016
28	.0148	.012641	.014
29	.0136	.011257	.013
30	.0124	.010035	.012
31	.0116	.008928	.010
32	.0108	.00795	.009
33	.0100	.00708	.008
34	.0092	.0063	.007
35	.0084	.00561	.005
36	.0076	.005	.004
37	.0068	.00445	....
38	.0060	.003965	....
39	.0052	.003531	....
40	.0048	.003144	....
41	.0044	.....	....
42	.0040	.....	....
43	.0036	.....	....
44	.0032	.....	....
45	.0028	.....	....
46	.0024	.....	....
47	.0020	.....	....
48	.0016	.....	....
49	.0012	.....	....
50	.0010	.....	....

We may remark that in England no contracts are valid or can be enforced, unless the specifications give the sizes according to the Standard Wire Gauge, which was adopted on March 1, 1884.

A Mercurial Ammeter.

M. P. Meardi, an Italian electrician, has devised an ammeter and voltmeter, which consists of a solenoid coil having in its hollow interior one arm of a U tube containing mercury, which rises to the same level in both arms. The thicker arm, which is that within the solenoid, holds a core of soft iron floating on it, so that when the solenoid is traversed by the current to be measured, the core is pulled downward into the mercury, which exercises a counter pressure upward. The result is that the level of mercury in the smaller arm of the tube rises or falls according to the strength of the current in the solenoid, and the latter is indicated by a properly graduated scale fixed along the smaller arm of the tube. While upon this subject, we may mention the application of Peltier's effect to the same purpose by M. Hescus. It consists of a differential air thermometer, having introduced into its two reservoirs soldered junctions of iron and nickel. An electric current passing through these wires causes the junction or junctions in one reservoir to heat and the other to cool. The effect on the column of the air thermometer measures the current; it being found that Peltier's effect is proportional to the strength of current. A Grenet element is stated to give a reading of four millimetres on the instrument constructed. Being a non-magnetic apparatus, it may be used very close to a dynamo without disturbance.

A New Protector for Electrical Instruments.

The danger to which many electrical instruments are exposed when subjected to abnormal currents has led to the devising of many different forms of "protectors." The apparatus shown in the accompanying engravings, and known as the "Cartwright" protector, is specially designed for use in connection with safeguarding telephone circuits, for which purpose it has been found to be very efficient. A novel arrangement in the instrument is that by which the ground connection is made through the armature and core of the electro-magnet.

The illustrations, Figs. 1 and 2, show respectively a plan and an elevation. Referring to these, it will be seen that an iron core *A* is supported at each end upon angle-irons *B*, attached to the base-plate. Upon this core are placed two helices, separated from each other at the centre of the core by a washer of hard rubber, and wound in the same direction, one from the centre of the core and the other from the extreme end of the core. The inside end of one of these helices is connected by means of wire and binding-post *F* to one side of the line, and the outside end of the helix is connected through the armature lever *H*, wires *a b* and binding-post *I* to one of the terminals of the telephone or other instrument. The other helix is connected to the other side of the line and instrument in a similar way. As shown by Fig. 3, a current entering from either side of the line will, when the armatures are not attracted, pass through both helices in the same direction. The armature-lever to which the armature *N* is attached is made of metal in bell-crank form, and is pivoted to the base-plate, so that the weight of the lever is sufficient to overcome the attraction of the armature caused by the normal current which passes through the helices.

Each of the angle-irons supporting the core rests upon a T-shaped metallic plate *L*, which is connected to the ground at *G*.

When the instrument is in its normal condition, and the current upon the line is of normal strength, the helices and the telephone, or other instrument which it is desired to protect, are in the circuit, as shown in Fig. 3. When a current of abnormal strength is put upon the line from any source, as might happen from contact with an electric

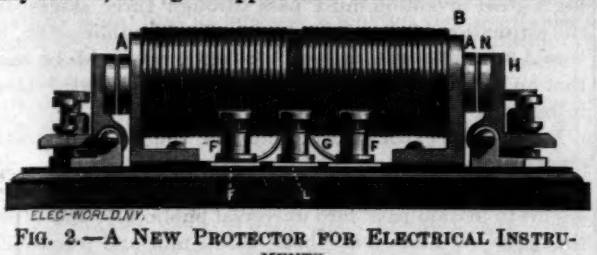


FIG. 2.—A NEW PROTECTOR FOR ELECTRICAL INSTRUMENTS.

light circuit with the telephone circuit, or from lightning, the armatures are instantly attracted, and the line is connected with earth through the armature, the core and pole-piece on the side from which the current enters; and the telephone or other instrument is cut out, and thus protected from injury, as shown in Fig. 4.

The helices are wound with coarse wire, so as to take heavy currents without injury. From the description it is apparent that no sparking takes place in the operation of the instrument. The circuit is never broken, the action of the abnormal current being to shunt the telephone or other instrument and at the same time connect the line to ground. Numerous trials have demonstrated that the instrument fulfills very well the object for which it is designed. Our cities are now so netted with electric light wires against the currents in which telephones are not protected, that the instrument should find a ready adoption and thus prevent the loss and danger from fire.

A Promising Electrical Enterprise.

It was announced by us editorially last week that the control of the Fuller-Wood system had passed into the hands of the American Electric Manufacturing Company, of this city. The papers of transfer were executed here on the 17th inst., between Mr. William H. Appleton for the Fuller-Wood Electric Light Company, and Mr. Edward H. Goff, President of the American Company. With the control of this long-established system goes possession of a new five-story factory on West Eighteenth street, said to be one of the best equipped in the country for the manufacture of electric light apparatus. It is understood that this factory will be run to its full capacity in turning out dynamos, while the lamps will be made at the factory of the Electrical Development and Manufacturing Company in Boston. By this division of work, it is hoped all orders can be executed promptly. At the present time, the American Company has on hand orders for $200,000 worth of new apparatus.

The Fuller-Wood system is familiar to most of our readers. It was one of the earliest to be tried in America, and to-day as improved in most of its details by Mr. James J. Wood, the electrician of the Fuller-Wood Company, it is giving great satisfaction in various parts of the country. One large central lighting station equipped with it is at Springfield, Ill., owned principally by Mr. Ide, of the Ide Engine Company, a gentleman who has given considerable time to the question of electric lighting. This plant has been in operation over three years, and has paid 10 per cent. per annum regularly since its installation. At Dayton, O., the streets are lighted by the system, and there are numerous plants in Chicago and other cities. The Fuller-Wood apparatus has not hitherto enjoyed the popularity it deserves, but is likely, under the auspices of the indefatigable president of the American Company, to be pushed for all it is worth.

Of course this step involves a cessation of the arrangement under which the American Company put in Thomson-Houston plants, when filling contracts. President Goff is careful to say that no fault whatever can be found with that system. The fact is that the American Company simply thought that with its experience, energy and capital, such as have been exhibited during the past three

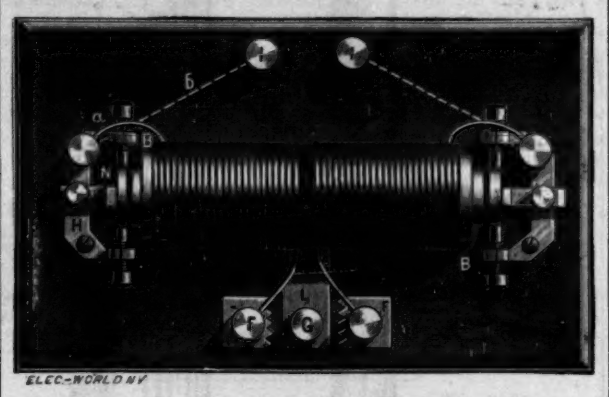


FIG. 1.—A NEW PROTECTOR FOR ELECTRICAL INSTRUMENTS.

years, it should have a system of its own, and thus reap the profits of manufacture, independent of all other corporations. Mr. Goff says that, as the result of careful examination and comparison, he is of opinion that the Fuller-Wood system is as economical to build and remunerative to operate as any other.

The American Company, thus advantageously circumstanced, and co-operating with the Edison Company for the introduction of arc and incandescent lights wherever a demand exists for the one or the other form, or both, seems bound to enjoy a large measure of prosperity in the era of business activity now begun all over the Union.

The Roberts Permanganate Battery.

For many years after the electric battery became a commercial success, attempts were made to obviate the disadvantage under which they labored, consisting in the fact that they destroyed themselves, whether they were at work or not. These closed circuit batteries, of which the many forms of Daniell and the Bunsen are examples, could not be economically applied where an electric current was used for a short time at long intervals, such as for bell-ringing and similar purposes. Although numerous efforts were early made to construct an open circuit battery, the first successful

NEW PERMANGANATE BATTERY.

one was that of Leclanché, which consumes material only during the time that the circuit is closed. In this cell, as is well known, the active agent is sal-ammoniac, dioxide of manganese being used as the depolarizer. Numerous forms of the Leclanché cell have been constructed since the introduction of the latter, differing from it more in mechanical construction than otherwise. The makers of most of them also, while using sal-ammoniac, were obliged to abandon the dioxide of manganese, the use of which was prohibited during the life of the patent of the Leclanché cell. In all these batteries the zinc chloride formed replaces the chloride of ammonium in the solution, and the efficiency of the battery diminishes in proportion as this action takes place.

Recently, however, a decided variation in open-circuit batteries has been brought about by the use of an entirely different solution from the one heretofore almost universally employed.

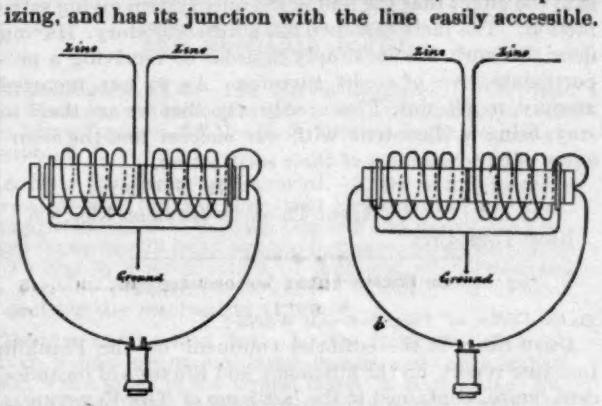
The new battery shown in the accompanying engraving known as the Roberts Permanganate, has a solution which consists of a base of permanganate of potash, to which is added the salt of an alkali, such as table salt, sal-ammoniac, or the like. After many trials the solution finally adopted consists of a mixture of permanganate of potash, bichromate of potash, table-salt and sal-ammoniac.

Precisely what the chemical action in this cell is, is not definitely known. The solution is gradually destroyed, and the waste of zinc is very slight and takes place through *oxidation*. Many analyses have shown, however, that it is not taken into solution, as is the zinc in the sal-ammoniac cells, in which respect it differs radically from the latter. It would appear also, from the slow consumption of the zinc, that the principal action takes place between the elements of the solution, and hence a cell may be repeatedly charged with new solution without a renewal of the zinc.

The electrical constants of the battery show it to be very favorable of economic application. Its electromotive force averages 1.8 volts and it has an internal resistance of about 7 ohms, thus giving a current of about 2.5 ampères on short circuit. A small but important detail of construction also deserves description, consisting in the method adopted for making a good contact between the line and the carbon. For this purpose the latter has a hole drilled in the top, into which is inserted a brass pin of smaller diameter. The remaining space is then filled with a metal which *expands* upon cooling and hence makes a perfect connection between the carbon and the threaded pin to which the line is attached.

An Indestructible Earth Connection.

Mr. Justin Malisz, after drawing attention to the defects of ordinary earth plates, describes his method of preparing an earth connection which conducts well, is self-depolarizing, and has its junction with the line easily accessible.



FIGS. 3 AND 4.—A NEW PROTECTOR FOR ELECTRICAL INSTRUMENTS.

A hole about 6½ ft. deep and about 3 ft. square is dug in the ground, and a layer of coke laid on the bottom and firmly stamped down. A tube with its lower end resting on the coke is placed against one face of the hole and filled tightly with coke almost to the top. The hole is then filled up and the earth rammed well round the tube, the upper part of which projects above the surface of the ground. A lump of coke or retort carbon, to which a copper band is rigidly attached by soldering or pouring molten lead over it, is put in the tube, and a final layer of coke pressed firmly around it. The copper band projects from the top of the tube, and to this band the line or the lightning conductor is soldered. By this arrangement a constant earth connection is obtained, as coke has a uniform conducting power under all circumstances, and its large surface insures for the current an easy path to earth. The column of coke in the tube not only enables the junction between earth and line to be permanently above the ground and easy of access, but it has a depolarizing action on the bottom layer of coke, thereby preventing the prejudicial effect of a counter-electromotive force, which in so many cases renders an ordinary earth-plate useless. Mr. Malzis considers that the coke, which in the upper part of the tube is in contact with the air, condenses oxygen, and can likewise absorb and oxidize the hydrogen formed by the current. The gases resulting from polarization rise through the column of coke in the tube, and are dissipated in the air, and this column, in virtue of its power of condensation, plays an important part in the depolarization of this form of earth connection.

Calibration of Measuring Instruments.

To the Editor of the Electrical World:

1. Can you inform me through your paper whether or no there is a work of any kind which treats exhaustively of the *calibration* and *use* of tangent galvanometers; also voltmeters and ammeters, and other testing instruments? 2. Would be much obliged if you would indicate in your paper the best method, in your opinion, of calibrating a tangent.

RALPH.

MANCHESTER, N. H.

ANSWER.—1. It would be difficult to name any one book which treats exhaustively of the instruments you mention, especially of the two latter, which are of recent construction. Vol. 2 of James Dredge's *Electric Illumination* has considerable of the matter you refer to, in very

simple form. Prescott's *Dynamo Electricity* also treats of the matter in an easy style. 2. Perhaps the *best* method of calibration is by comparison with the horizontal component of the earth's magnetism or with a standard coil. A very *convenient* method, and the one most generally employed, consists in determining the electrolytic action of the current in a copper or silver voltmeter. When carefully undertaken, the latter process gives good results.

Lighting the Croton Aqueduct Works.

To the Editor of the Electrical World:

SIR: The prosecution of the work upon the new Croton Aqueduct by the aid of electric lights has been referred to in your paper upon several occasions, but perhaps a few late facts will be of interest. In your issue of Aug. 29, the representative of the Ball Company is quoted as saying, in the course of a debate before the National Electric Light Association: "I refer to the Croton Aqueduct. There are five companies represented there—the Ball and four others. Two dropped out and the other two are anxious to get out." This is interesting, but scarcely correct. Of the twenty odd shafts sunk along the line, fifteen are now lighted by arc lights, four companies being represented.

The shafts lighted by each are as follows;

	Capacity of dynamo.	System.
Shafts, 9 and 11A each	10 lights.	Schuyler.
" 17	12 "	United States.
" 12-16-19 each	10 "	Ball.
" 13-15-20-21 each	10 "	Thomson-Houston.
" 14-18-22-23-24 each	15 "	

Recapitulation:

Schuyler	2 shafts,	with a total of	20	lights	capacity.
United States	1 shaft,	" "	12	"	"
Ball	3 shafts,	" "	30	"	"
Thomson-Houston	9 "	" "	115	"	"

The Thomson-Houston, therefore, are lighting 9 shafts with a total of 115 lights, as against 6 shafts with a total of 62 lights of all other systems.

The natural inference from the statement above quoted is to the effect that the Ball is the only system giving satisfaction. The facts as shown tell a different story. Having done the work, we are simply desirous of receiving a proportionate share of credit therefor. As to our reported anxiety to get out, I can only say that we are there to stay, being well content with our success and the assurances of our customers of their satisfaction.

H. N. CURTIS,
Agent Thomson-Houston Elec. Co.

NEW YORK CITY.

The White Incandescent Lamp.

To the Editor of The Electrical World:

DEAR SIR: In the editorial comment on the Franklin Institute report on the efficiency and life tests of incandescent lamps, contained in the last issue of THE ELECTRICAL WORLD, occurs this statement: "It will be noted, however, that these (the Edison) as well as the others fell considerably in illuminating power during the duration of the test."

The writer of the above would seem to have overlooked the facts given in the report concerning the "White" lamps, the latter being the only ones tested which did *not* show a falling off in illuminating power.

BOSTON. Respectfully yours, CLINTON M. BALL.

[Our comments in the editorial referred to were based on the lamps entered for competition only. The White lamps were not tested long enough to bring out their full qualities, and as we observed that their illuminating power increased, they were evidently not included in the above category.—EDS. E. W.]

Telephonic Apparatus.

To the Editor of The Electrical World:

SIR: Will you please answer the following questions: 1. How can I obtain a Freeman transmitter as described in your valuable paper, vol. 5, No. 24, page 233? 2. Does it work well? I wish to try it on a new receiver. 3. What is the claim of the Bell patent? 4. Would a receiver with no electro-magnet be any infringement on any of their patents?

C. T. ISBELL, Kendallville, Ind.

ANSWER.—1. Apply to the inventor, Mr. James P. Freeman, Chicago, Ill. 2. We have no information respecting its efficiency. 3. There are a number of claims. Procure patents issued to A. G. Bell, dated March 7, 1876, No. 174,465, and Jan. 30, 1877, No. 186,787. 4. We believe that the Bell Company would consider it as an infringement.

Points on Batteries

To the Editor of The Electrical World:

SIR: 1. Can you give me the number of batteries which will run an incandescent lamp of 1½, 2 or 3 c. p.? 2. Also the E. M. F. of an "old-style" Law Telegraph Battery? E. F.

BLOCK ISLAND, R. I.

ANSWER.—Three or 4 Bunsen or bichromate cells will be sufficient. 2. About 1.25 volt.

To the Editor of The Electrical World:

SIR: How short a distance between centre of engine and dynamo is it practicable to have with an 8-inch double belt transmitting 25 h. p., and belting from a 4-foot to a 15-inch pulley? Yours respectfully,

W. C. BRYANT.

ANSWER.—We should advise not less than 8 or 10 feet.

Kohlrausch's Spring Galvanometer.

Of the several forms of galvanometers recently devised for practical work, spring galvanometers seem to have met with most favor, as they do not contain the inherent faults of several other forms. Among the more recent instruments of this class devised by Professor Kohlrausch, is that seen in the accompanying engravings. Fig. 1 shows the galvanometer adapted to be fastened to the wall. Fig. 2 shows the instrument upon a tripod.

It consists of a brass tube, slotted as shown, and around

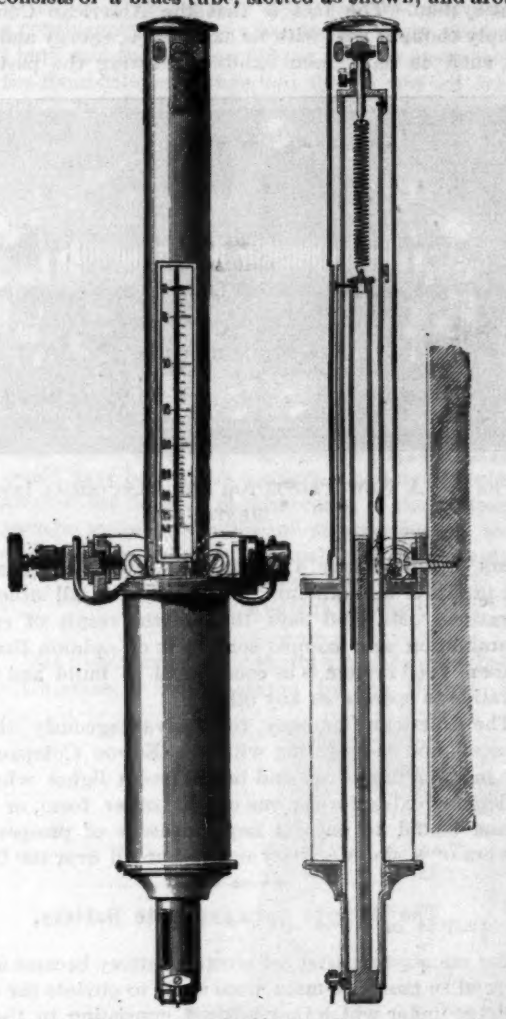


FIG. 1.—KOHLRAUSCH'S SPRING GALVANOMETER.

the lower end of which the wire helix is wound. Its upper end is closed by a suspension device which carries a steel spring, to which a thin iron tube, 20 centimeters in length, is attached. The upper end of the tube is guided

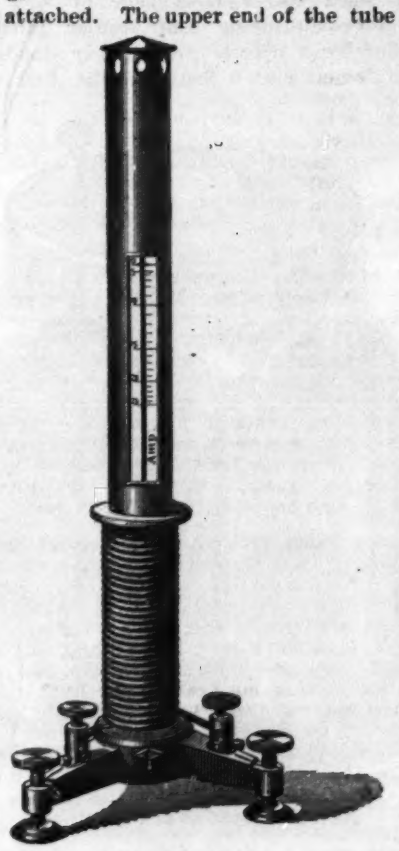


FIG. 2.

by a pin which slides in the slot and carries the pointer. The lower end of the tube is guided by a smooth rod fastened to the bottom of the brass tube. This guide rod is a trifle smaller than the tube, so as to avoid friction.

It is designed principally, however, to act as a damper, and thus avoid the violent motions which would otherwise occur. Its action is similar to that of a dash-pot, the air acting as a cushion.

The brass tube carries two scales, one on each side of the slot. One of these is graduated to volts or ampères, and the other to millimetres. The latter scale is added so that it may serve as a reference, especially in the case of voltmeters, in measurements beyond the limits of the reading scale.

The upper part of the instrument is covered by a tube, which is slotted so as to exhibit the scales, the slot being closed by a sheet of mica, so as to exclude all dust. This protecting tube acts also as a ventilator, being perforated at the top. It will also be noted that the foot of the instrument has large openings for the admission of air; the main brass tube has in addition several holes immediately above the solenoid. These openings provide good ventilation for carrying off the heat generated by a prolonged use of the instrument. The direction of the current is indicated by a small magnet provided with a pointer and pivoted to the base of the instrument.

When designed to serve as a voltmeter, the helix consists of very fine double-covered wire. As an ammeter, it is wound with wire according to the strength of current. For currents of 100 ampères and more, bare wire of rectangular cross-section is used, ranging from 60 to 250 sq. mm. The air acts as the insulator, and serves to keep the coil cool.

This instrument, which has lately been imported by Messrs. Queen & Co., of Philadelphia, evidently possesses a number of valuable features, and its large scale makes it very convenient to read at a distance.

Analyzing a Sensational Invention.

Last week we described and illustrated the "great" invention made by a Mr. Brown, of Texas, for telegraphing without batteries. Mr. Thomas D. Lockwood, in a line of criticism like our own, but with far more pungency and vigor of expression, has the following to say on the subject:

We learn that the transmitter of the new invention is simply a horseshoe magnet, either pole being covered with fine wire coiled carefully; and that the armature is a disc of steel, against which the voice is thrown, to be transmitted through the magnet to the wire; also that the receiver is similar, but has a smaller magnet.

Since the telephone was first publicly given to the world by Bell, in a paper read before the American Academy of Arts and Sciences, in May, 1876, it has been a common thing for those whose "wish was father to the thought," to deny his inventorship, and to ascribe that merit to Reis, Meucci, Cammack, Edison, Gray, Drawbaugh—any one, in fact, to beat Bell. James Watt said that any one making a great invention must pass through three stages in the estimation of the great mass of the public—first, it would be said it was impossible; next, it would be said that he had not done it; finally, it would be asserted that it had long been known.

Mr. Bell has experienced to the full the truth of these observations.

It has, however, rarely been the fate of an inventor to see his invention pass into universal public use, and after the lapse of nine years hear that a new and wonderful achievement of science has been produced, which when described proves to be exactly his own idea. Yet such is the case in the present instance, for the description given of Mr. Brown's new telephone describes exactly the telephone of Mr. Bell before the battery transmitters of Edison and Blake were added.

From its first production in 1876 until some time in 1878 every telephone in use was operated without batteries; and the battery transmitter was a subsequent invention, added to increase its efficiency.

The Bell magneto-telephone was described in the *Transcript* of Oct. 19, 1876.

So far as telephony is concerned, therefore, the wonderful instrument of Mr. Brown is almost a Chinese copy of the original Bell telephone.

It is also, however, implied that this instrument is likewise an innovation in telegraphy. Referring to page 538 of "Electricity and the Electric Telegraph," by Prescott, edition of 1879, we find a description of a complete system of magneto-telegraphy, invented by the well-known German electricians, Siemens and Halske, which fully anticipates this feature.

Finally, referring to the United States Patent Office records to ascertain what it is that Mr. Brown really invented, we find that the only patent as yet issued to him is No. 324,746, bearing date of Aug. 18, 1885, and entitled magneto-electric telegraphy; and that an analysis of this patent resolves it into a new form of key combined with the use of a Bell telephone in lieu of an ordinary telegraph sounder.

Such a use was anticipated by the patent of Orazio Lugo, issued Dec. 7, 1880.

As to the financial success of Mr. Brown, it is hardly to be believed that men like Mr. Gould or Mr. Corbin, or that corporations like the Western Union Telegraph Company or the Bell Telephone Company, could be beguiled into parting with a million of dollars for an invention which five minutes' conversation with a competent patent attorney would show to be scarcely worth so many mills.

Suits of Interest to Electric Light Men.—In a half-page advertisement in this issue, the Ansonia Brass and Copper Company give notice that they will enforce their rights in the courts against those manufacturing or using covered wires infringing the Cowles patent. Licenses under the patent have been granted to Messrs. Holmes, Booth & Haydens, and the American Electrical Works, and these are the only authorized manufacturers. Suits have already been instituted against those manufacturing and even some of those using wire of the character covered by the patent.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Sept. 24, 1885.

There is at present on exhibit in Room 22, No. 7 Exchange place, a mechanical telephone. This apparatus possesses considerable merit, and its inventor, Mr. G. W. Lord, deserves a great deal of credit for perfecting this useful little instrument, by which sounds may be distinctly carried around any number of angles a distance of at least half a mile. The equipment and fixtures of this mechanical telephone are somewhat similar to that of the old style of "acoustic" telephone, but differ from the latter in the ability given to overcome the difficulties which have often rendered the "acoustic" impracticable. Dr. W. E. Townsend has the instrument under his charge, and will be pleased to give full particulars either in person or by letter.

One evening last week a party of gentlemen met at the office of the Patent Battery Company, No. 51 State street, to witness another test of incandescent lighting from a primary battery. During the exhibit five 16 candle-power lamps were alternately lighted and extinguished in rapid succession, and subjected to all manner of experimental tests. By means of a single lamp, the time was easily and clearly distinguished on a watch held 150 feet distant, and at the distance of 90 feet a newspaper was read without any difficulty. Everybody present at the test was fully satisfied that the claims made by the inventors, Messrs. Kauffer & Goldner, were indeed modest when compared with results shown at the exhibit of incandescent lighting above referred to.

A new pneumatic call box is being manufactured by the Electrical Development and Manufacturing Company, of this city. One of the main features of this ingenious apparatus is that it is perfectly noiseless in its working, which makes it specially adapted for use in hospitals, sick-rooms, libraries, and all places where quiet is desired. Another noticeable feature in this call box and not seen in any other, is a peculiar mechanism, whereby visual notice is given of the completion of the work by the box. The same company is at present making a nest of a dozen relays for the Boston Fire Alarm Headquarters, which demands the combined care of practical and expert electricians and the labor of skilled machinists.

The Thomson-Houston International Electric Company has received an order for electrical apparatus for lighting the entire city of Hermosand, Sweden. This contract is made directly with the city government, which will own and operate the plant. The first shipment of apparatus will be made this week. The city possesses a valuable water-power, which will be used for driving the dynamo machines. The Thomson-Houston International Electric Company states that its business is looking very favorable abroad, and that it is now negotiating with a number of large cities in Europe for several plants, ranging from one hundred to four hundred arc-lights each.

The Judkins Railway Train Signal is to be placed on the trains of the Milwaukee & Northern and the Michigan & Wisconsin Railroads. An employé of the Judkins R. T. S. Company left Boston for the West on Tuesday in charge of the necessary equipment for the roads mentioned.

Mr. Albert Storer, electrician, No. 40 State street, Boston, is at present engaged upon some highly artistic and ingenious electrical and mechanical work for inventors and others. Most worthy of mention are his experimental work and improvements on the Oram Time Repeater, under the direction of the inventor; and the making of the automatic circuit-closers in the clockwork and other delicate parts of the Electro-Polargraph.

Electric light is to be introduced in the Nulhegan Lumber Mills at North Stratford, Conn.

The Friends' School at Providence, which has been using the Edison system of incandescent lighting for more than two years, has applied for an increase in the number of lights.

The Financial Telegram Company have taken magnificently fitted-up offices at No. 54 Devonshire street, Boston.

The headquarters in this city of the Metrical System for cabling are in the offices of the New England Heat, Light and Power Company, No. 178 Devonshire street.

The Peruvian Electrical, Construction and Supply Company is vigorously pushing its business in Peru, S. A., and expects to have all the business portion of Lima lighted by the latter part of November. This plant would have been in operation at a much earlier date had the work not been delayed by the death of Mr. Charles H. Foster, the first expert whom the company sent out to Peru. The company is in receipt of information from a number of Peruvian cities stating that as soon as the Lima plant is in operation orders will be forwarded for complete electric lighting plants. A stipulation in the grants from the Peruvian government under which the Peruvian Electrical, Construction and Supply Company operates specifically demands that the lights shall be installed in the capital city before they are introduced elsewhere, consequently it is somewhat retarded in its business until the Lima plant is in operation.

Mr. W. J. Keenan, of the firm of Keenan & Wilson, No. 40 State street, reports having the improved battery which his firm have been busily engaged upon for several weeks past, now ready for placing in the market. The Boston Time Company has been using several of the Keenan-Wilson batteries on trial with satisfactory results; and the New England branch of the metrical system for cabling is about testing a number of these batteries with the view of adopting same.

The St. John's Electric Lighting Company, of St. John's, N. F., which recently purchased a complete plant of 90 arc lights from the Thomson-Houston International Company, is rapidly completing its installation, and expects to have the lights in operation within the next 30 days. This company will operate the Thomson-Houston system exclusively.

The Thomson-Houston Company were practically unknown in England before winning the gold medal at the Inventories, their system never having been introduced there. They sent over their apparatus in charge of an electrical expert, and exhibited it purely on its merits. The system was subjected to the most severe tests that could possibly be made to demonstrate the workings of the various important features which it possesses. On the first visit of the jury, they requested the expert to cut out lamps, twenty, twenty-five and thirty at a time; to short-circuit the machines; pour oil on the commutators, and, in fact, do everything which would naturally tend to damage any dynamo machine. The jury comprised some of the greatest scientists of England, and the remarkable efficiency of the automatic features of this system, together with the fact that little or no depreciation could be discovered during a running period of 90 days, appeared to them in the light of a revelation. In their report upon the workings of the Thomson-Houston system, the jury say that from the time of starting up the lights to the day of submitting their reports there had been not one moment's cessation from any causes attributable to the machines or lamps. The fact that the highest honor in the gift of the Commission has been bestowed upon the Thomson-Houston Company in the face of the strongest competition ever entered into at any electrical exhibition in which every prominent electric lighting company of Europe and the United States took an active part, speaks for itself. The award, which was the only gold medal given for arc lighting, was made on the 11th of August, at the London Inventions Exhibition Building, London, England.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Sept. 23, 1885.

The Lemont Gas and Electric Light Company has been incorporated at Springfield.

The money appropriated by the City Council and Board of County Commissioners for lighting the City Hall, Court House, Hospital, Insane Asylum, Poor House and Criminal Court buildings with electricity has been pretty nearly all earned now. The work was to be completed, under the terms of contract, on the 15th inst.

THE TELEGRAPH.

Personal.—Mr. P. B. Delany, the inventor, has been heard from in London, England, where he is showing the Britishers the wonderful mysteries of his synchronous system.

Filling a Gap.—Mr. N. M. Booth, Evansville, Ind., agent for the Western Electric Company, has sold President Mackey, of the E. & T. H. R. R. Co., 60,000 pounds B. best galvanized wire for the new line now being constructed to fill up the gap between Indianapolis and Evansville.

T. M. B. A.—Mr. Geo. M. Dugan, Superintendent of Telegraph, Illinois Central Railway, has been appointed agent of the Telegraphers' Mutual Benefit Association, at Jackson, Tenn., to succeed Mr. J. H. Bard, who is traveling to introduce his patent wire hoop mentioned by us not long ago.

Telegraphs in Corea.—It is stated that various lines of telegraphs are to be constructed in Corea under the superintendence of Chinese officials. The preliminary surveys have already been commenced between Gensan and Seoul, and at various points on the Chino-Corean frontier. The length of the lines actually undertaken is over 400 miles.

All Pay and No Work.—The four American telegraphers who went to Siam on contracts guaranteeing them $120 a month make an unflattering report of the country and its business. About twenty-five messages a month are transmitted; the Americans have not yet had any, and one of their predecessors declares that in three years all the business he did was to sign vouchers for his pay.

Operators Conciliated.—The committee of Western Union telegraph operators at St. Paul, Minn., reported to a full meeting on Sept. 20 the new policy of the Western Union, to employ extra operators for extra work. The committee recommended that the same be received in good faith and acted upon accordingly. The meeting adopted a resolution in accordance with the report. It is understood that extra operators will be on duty regularly.

A Reason Why.—Mr. Leavitt Hunt says in a letter written last week: When Professor Morse was engaged in the slow and tedious process of laying his first telegraph wire underground between Washington and Baltimore, a sudden shower compelled him to seek shelter under a bridge. While waiting there, he remarked to his son Charles (who told me of the incident), that "when it was first proposed to use glass window panes in England, it was strongly objected to as impracticable on account of the risk of their being smashed. Glass was used," continued the professor, and from here on I mean to string my wire on poles and take the risk." And henceforth poles were used.

Married on a False Telegram.—A dispatch from Buffalo, N. Y., says: In 1880 a German woman was married in this city and lived with her husband two years. The husband deserted her, married again and fled to Canada. Last spring the lawful wife received a telegram, purporting to come from her brother-in-law, stating that her husband was dead. She preserved the telegram and accepted the information as true, not hearing anything to the contrary. This summer she was married again to a respectable business man of this city. A few days ago her first husband reappeared and confessed that he had sent the false telegram, thinking it would relieve him of the charge of bigamy. The matter is now in the hands of a lawyer, but the names are withheld for the present. The situation is further complicated by the fact that the Catholic Church, to which all the parties belong, does not sanction divorce.

The Telegraph Conference at Berlin.—The delegates to the Telegraph Conference have presented Dr. Stephan, the president, with a handsome and costly punch bowl, made of silver and crystal. The banquet given by him to the delegates, on the 17th inst., was a grand affair. Count Herbert Bismarck and a number of other notable persons were present. The delegates signed the business documents today and will now return to their respective homes. The conference will reassemble in Paris in 1890. Mr. Stephan, in his farewell address to the delegates, expatiated upon the strides that had been made in reforming and unifying the tariffs, and expressed himself as confident that the next conference would complete the good work. He eulogized the zeal and devotion of the delegates and assured the conference that it had the best wishes of the Imperial Government. He concluded with the expression of the hope that the delegates would carry home with them pleasing memories of Germany. The English and Portuguese delegates replied on behalf of their colleagues.

THE TELEPHONE.

A Bogus Customer.—The telephone has been used at Providence, R. I., by a young fellow, for obtaining goods under false pretenses. The firm selling the goods filled the orders as they came in by telephone, and when delivery was made, the victimizer walked off with them.

At Last.—The directors of the Erie Telephone and Telegraph Company have declared a dividend of one-half of 1 per cent., payable to stockholders of record Sept. 30, to be mailed by check Oct. 26. The dividend is on 48,000 shares and amounts to $24,000, and, if good assets are considered, the debt would be entirely wiped out. The company's financial standing enables it to borrow money at 4 per cent.

Well Put.—Year by year the telephone is making its way into our business system, until it has become intrenched as an integral part of the same; no longer a luxury, but a prime necessity. Whatever the result of the suit started the other day by the United States to test the validity of the Bell patents, the telephone will remain, as it now is, despite monopolies and high charges, one of the most important adjuncts of every well-regulated business establishment. The telephone is a great institution. How did we ever transact business so long without it?—*Iron Trade Review.*

The Late Mr. Gower.—There seems to be little doubt now that Mr. F. A. Gower, well known in connection with the Gower-Bell telephone, has perished in his latest balloon ascent. He was at work upon his proposal to drop dynamite or other explosives from balloons in warfare in order to blow up fortifications, and it appears that the deceased gentleman, in his ardor for aëronautics, had become a practical balloonist. On July 17th he left Cherbourg in a balloon for the purpose of testing some new automatic apparatus for obtaining equilibrium of the balloon at desired altitudes. The balloon, which was named the Ville d'Hyères, was subsequently found by some fishermen between Dieppe and Tréport floating on the sea. The cords which sustained the car had been cut, and it is thought that Mr. Gower has perished in the North Sea after cutting the car adrift. The latter has not been found yet, and there is just a faint glimmer of hope that it may have been picked up by some sailing vessel making for America. Mr. Gower was a comparatively young man, and had realized a considerable fortune.

THE ELECTRIC LIGHT.

Washington D. C.—The Jarvis Engineering Co., Boston, Mass., have received orders to set a tubular boiler with the Jarvis furnace for the U. S. Electric Light Co., Washington, D. C.

A Fair for Grant's Memorial.—There is a proposal to give a monster fair for the Grant Memorial in New York. The place selected is Madison Garden, and one of the principal features will be an electric fountain, on which will be given nightly a combination of fantastic effects designed to show the possibilities of electric lighting. Mr. Edison is devising the mechanism, it is said.

Danger in the Gas Jet.—A. C. Hopkins, of Lockhaven, a business man of large means and wide experience, was a guest in the Grand Hotel in Harrisburg, Pa., last week, and by a mistake came very nearly ending his life. The hotel is illuminated by Edison's electric light. The globes are attached to the gas jets, and the light is turned on and off by keys similar to those which regulate the gas. The keys are very nearly together. In the night Mr. Hopkins got up and turned on the light. By accident, he thinks, he also turned on the gas. On retiring to bed he turned off the light, but left the gas on. Toward morning he awoke and felt the influence of the gas, which had filled the room. He was so stupefied that he could not arise. He retained his senses, however, and rolled out of bed, crawled to the door, and, having opened it, touched the electric bell button. A servant responded and a doctor was called who administered restoratives. He said that in half an hour Mr. Hopkins would have been dead.

APPLICATIONS OF POWER.

Transmission of Force in France.—A new installation for the transmission of force has recently been inaugurated at Tergnier, in the Magasins Généraux, to actuate, at a distance of 180 metres, an apparatus which serves to elevate the molasses, etc.

Toronto, Can.—The Van Depoele electric railway at the Toronto Industrial Exhibition is a perfect success. The length of the track is about a mile. The cars run fifteen hours a day continuously, the total time for a round trip being 10½ minutes. The run over the track takes 2½ minutes. The current is conveyed to the motor by an overhead wire. The travel is from 6,000 to 10,000 passengers daily.

Extension of an Electric Railway.—The electric railway, which has been in operation since April, 1884, between Moedling and Brühl, in the suburbs of Vienna, is about to be extended to Hinterbrühl; its length will thus be increased from 3 to 4.5 kilometres. The system adopted is that of Messrs. Siemens, by which the current is produced at a fixed point and transmitted to the motors of the cars by metallic conductors along the route. The power is at present generated by five dynamos, each giving thirty ampères, with a difference of potential at the terminals of 500 volts.

Transmission of Power in New Zealand.—It is reported from New Zealand that a Dunedin electrical engineering firm is carrying out a contract for the transmission of power to run a stamping battery of twenty heads. The scene of operations is a gold mine in the mountainous country, some thirty miles behind Lake Wakatipu, and the power to run the battery is transmitted from a waterfall in the neighboring valley, straight over a mountain of about 2,000 ft. in height, and for a distance of about two miles. The conducting wire is of the same size as an ordinary telegraph wire, but of copper, and is suspended from telegraph insulators in the usual manner.

Electric Railways.—With reference to the application of electricity to the working of railways, the second section of the Railway Conference at Brussels reported that, in view of the great progress which had already been made in this respect, they look forward to further improvements;

but they made no recommendation. Eventually, however, the second and third sections consulted together, and reported that considerable progress has been realized in the employment of electricity on railways, and that it is probable that further progress will be made, which will largely augment their security. They further reported that it would be desirable to ascertain whether preference should be given to electricity or to mechanical appliances, and that this is a question for the future, having regard to the necessities of distance, climate, and the nature of the apparatus, which can only be decided by experience.

MISCELLANEOUS NOTES.

An Electric Log.—The Indian troopship *Crocodile* made recently a two hours' full-power trial of her machinery. During the run a trial was made of a new electric log for determining the speed of the ship at any given moment. It worked very well for some time, but was eventually carried away by the strain thrown upon the electric connections.

A Condition of Electrical Conductivity.—A paper was recently read before the Paris Academy of Sciences on the electric conductibility of solid mercury and of pure metals at low temperatures, by MM. Cailletet and Bouty. From numerous experiments made with mercury, silver, tin, aluminum, magnesium, copper, iron and platina, the authors conclude that the electric resistance of most pure metals decreases regularly when the temperature is lowered from 0° to 123°, and that the coefficient of variation is apparently much the same for all. It seems probable that the resistance would become extremely slight at temperatures lower than 200°, although this point has not yet been practically tested.

Fortunate Cyrus.—Mr. Cyrus W. Field, the fortunate holder of policy No. 421 of the Mutual Life Insurance Company, of New York, was insured for $10.000 in 1843, at the age of twenty-four. He has paid in all $8,514, and his policy is now good for $26,842, if it should be paid this year, or $18,328 more than his premiums.

Buffalo, N. Y., Electrical Society.—At the last regular meeting of the society the reports of the officers showed the organization to be in a flourishing condition, both financially and numerically. An election of officers was held with the following result: President, Frank Kitton; Vice-President, Harvey D. Reynolds; Secretary, Astley C. Terry; Treasurer, Charles H. Carter; Librarian, S. T. Davidson; Executive Committee, Joseph W. Larish, George A. Burnett and William Finn. At the next meeting of the society, to be held on Friday, Oct. 2, Prof. A. L. Arey will lecture on the subject of "Thermo-Electricity."

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Dist., b 19, a 24; Am. Cable, b 63, a 63½; B. & M., b 1, a 1½; Western Union, b 68½, a 68⅝.

Telephone.—Am. Bell, b 190, a 191; Erie, b 27¼; New England, b 28, a 29¼; Mexican, b 1¼.

Electric Light.—Edison, b 50, a 60.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales, 16 Maiden Lane, New York.

Messrs. Hine & Robertson, 12 Cortlandt street, sole sales agent for Kellam's Steam Damper Regulator, have sent us the two following letters, which speak for themselves:

FALL RIVER, July 5, 1885.

Edison Elec. Ill Co.:

The regulator is working very finely on less than two (2) pounds of steam; it is in all respects a perfect machine.

W. H. DWELLY, Jr., Treas.

AUBURN, May 25, 1885.

Brush-Swan Electric Light Co.:

It is a capital device for regulating steam pressure and saving coal. We can recommend it and would not know how to get along without them on our boilers.

B. C. SMITH.

Dean's Rheumatic Pills

Are a sure cure, a superior remedy, almost infallible; 50c.
HALE'S HONEY, the great cough cure, 25c.. 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown, 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED SEPTEMBER 8, 1885.

Incandescent Lamp; Otto A. Moses, New York, N. Y..... 325,958

Consists of a filament formed in the shape of two incomplete circles united with each other by a curved continuation.

Electric Battery; Emil G. Hammer, Brooklyn, N. Y..... 326,033

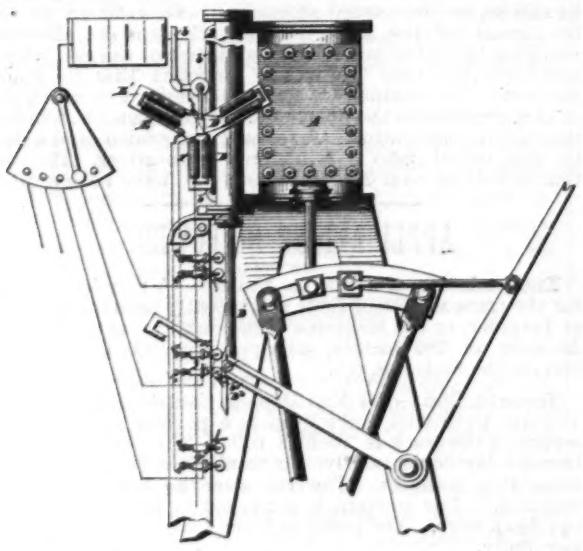
Consists in the porous sack inclosing one element of the battery and packed with the exciting material, in the stoppering rubber ring surrounding the sack, in the special preparation of the sack, and in other special details above indicated.

Railway Signal; Illius A. Timmis and Stanley C. C. Currie, London, England..... 326,068

Consists of a movable signal and an electro-magnet whose armature is attached to and adapted to revolve a shaft, and of a rod attached at one end to the signal and at the other to a crank upon said shaft, whereby when the armature is released the said rod will assume a position of alignment with the crank, and thereby lock the signal against accidental movement.

Printing Telegraphs; Clarence L. Healy, Brooklyn, Assignor to Stephen D. Field, Yonkers, N. Y..... 326,084

Consists in arranging in a circuit connected with or influencing the press-circuit, an electromagnet so arranged that it will be put into action by operating the key or other like device for establishing a current in the press-circuit,



326,337. APPARATUS FOR CONTROLLING MARINE ENGINES.

and will continue its action in such manner as to maintain the press-current during the time necessary to effect the proper action of the press-circuit mechanism, and will break or interrupt the press-current after such press mechanism has been acted upon as required.

PATENTS DATED SEPTEMBER 15, 1885.

Electric Arc Lamp; Richard F. Jones, St. Louis, Mo..... 326,123

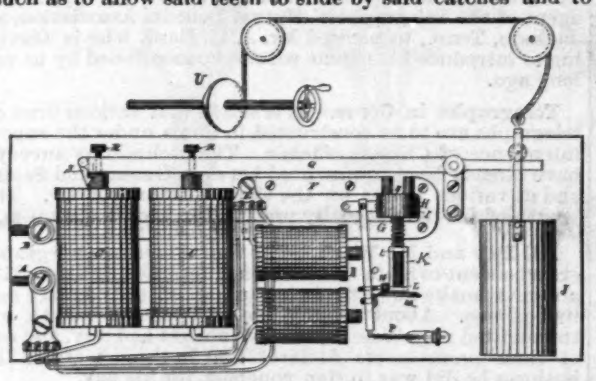
Consists of levers for grasping the upper carbon, armature rods connected to and extending upward from the levers, plates connected to the armature, and through which the lever-rods pass, and set-screws in the free ends of the plates adapted to come against a fixed object as the armature falls.

Gum Balata Applied to Wires for Insulation; Peter C. Matherson..... 326,132

Consists in dissolving the gum in a volatile solvent, and then passing the wire through the solution to receive a film thereof.

Electric Signal; Frederick G. Sargent, Westford, Mass..... 326,158

Relates to electric signaling apparatus, and is more especially adapted for use in telephonic circuits, to enable the central office to signal any one of a number of sub-stations on a circuit without at the same time calling any other sub-station on the same circuit; and it consists o fat disc provided with teeth having inclined faces and with a half-tooth or a tooth having a straight front face and an inclined rear face, a lever pivoted near its middle and provided at each end with a catch, the rear one of said catches having inclined front and rear faces, and the other one of said catches having an inclined front face and a straight rear face, the inclination of said teeth and catches being such as to allow said teeth to slide by said catches and to



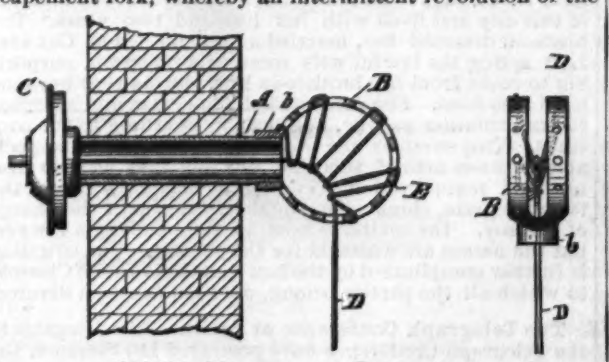
326,223. AUTOMATIC STOP APPARATUS.

rock said lever on its pivot when said disc is rotated, clock-work to rotate said disc, an electro-magnet and its armature secured to said lever above the front catch thereof, whereby said disc will be stopped at the end of a complete rotation by said front catch engaging said half-tooth, and will be stopped whenever said armature is attracted by said magnet by said rear catch being held against the front face of one of said teeth.

Electro-Magnetic Log; Lorenzo B. Favor and Charles A. Jacobs, Gloucester, Mass..... 326,207

Relates to that class of electro-magnetic logs in which a screw propeller, a registering instrument and an electro-magnet and circuit are constituents, the revolutions of the propeller while it is overboard being indicated by the registering instrument in order to show the rate of speed or distance run of a navigable vessel from time to time.

In each revolution of the propeller an electric diaphragm will be borne against a point and will spring away therefrom, the circuit being closed while the point and the diaphragm may be in contact and open or broken when they may not be touching each other, such causing a magnet and a spring to produce vibrations of a lever and an escapement fork, whereby an intermittent revolution of the



326,458. MECHANICAL TELEPHONE.

escapement wheel will be produced so as to correspondingly revolve a shaft and a worm.

Automatic Stop Apparatus for Motors Driving Dynamos; Oscar F. Jönsson, Stockholm, Sweden..... 326,223

Its object is to prevent the destruction of the dynamo-machine when interruptions or short circuitings occur by instantly stopping the motor. Consists of two electro-magnets *C* and *D* in the main circuit, acting each upon its lever-armature, in combination with a string and weight *J*, strips *F* and *G* and movable vessel *I*, which contains mercury and is controlled by one of the electro-magnets, the said stop apparatus effecting in an automatic manner the stopping of the motor driving the dynamo-machine in the event of interruption of the circuit or short-circuiting.

1. **Telephone Receiver**..... 326,268
2. **Telephone Transmitter**; William Burnley, North East, Pa., Assignor of two-thirds to Charles A. Hitchcock, of same place, and Lewis F. Watson, Warren, Pa..... 326,269
3. **Induction Coil**..... 326,270

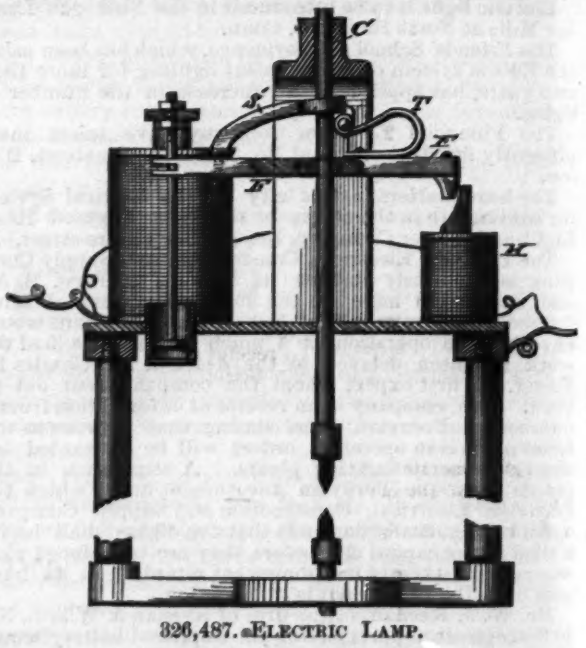
1. Under the diaphragm is provided a helix having bunches of wires of magnetic material, forming additional poles placed within the helix.

2. The electrodes are two carbon cylinders. These are loosely mounted in a yoke formed of a base having ends turned up therefrom, these ends being slotted, the pencils lying therein, one upon the other, and supported at their ends in the slots of this yoke.

3. Consists of a continuous core having a series of discs mounted thereon in pairs, whereby the length of said core is divided into several sections, a primary wire wound in two or more independent sections adapted to be connected in independent circuits, and a secondary wire also wound in sections.

Controlling Marine Engine; Louis M. Sanders, Roseville, Mich..... 326,337

It is designed to provide an electrical apparatus whereby the operation of a marine engine may be controlled directly by the captain or pilot without the necessity of signaling to the engineer. When the armature is over the magnet *F*, the steam is cut off from the cylinder *B*; when said armature is attracted to the magnet *D*, the valve is so rotated as to admit steam to the upper end of the cylinder



326,487. ELECTRIC LAMP.

B, and when the armature is attracted to the magnet *E*, steam is admitted to the lower end of said cylinder.

Mechanical Telephone; Henry Seligman, Irvington, N. Y..... 326,458

Relate to means for guiding and holding the wire when turning an angle. *A* represents a pipe or tube (an ordinary gas-pipe answers the purpose very well), provided at the ends with a screw-thread. This pipe or tube is set into and extends through the wall or partition of a building. The ring-shaped or circular angle-hanger *B* is provided with a stud *b*, in which there is an interior screw-threaded portion. This is screwed on the exterior thread on the end of the pipe *A*. This arrangement affords an economical and substantial means for securing the angle-hanger to the wall and centring it.

Electric Lamp; James Du Shane, South Bend, Ind..... 326,487

S is a ring-clutch surrounding the upper carbon and tube, and having the arm or lever *S'* formed upon it and standing toward the coils *C*. The opposite side of the ring-clutch is united by a joint to the curved spring *T*, which is bolted to the lever *F* on the side toward the coil *K*. The carbon or tube passes loosely through the clutch, which bends thereon on the side toward the coil *K* at the point *c'* on the upper edge of its opening *h*, and on the side toward the coils *C* at the point *c* on the lower edge of its opening.